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MOTORSHIP

Devoted to Commercial and Naval Motor Craft

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MOTORSHIP

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PUBLISHED MONTHLY IN THE INTERESTS OF COMMERCIAL AND NAVAL MOTOR VESSELS
AND FOR RECORDING PROGRESS OF THE MARINE
INTERNAL-COMBUSTION-ENGINE

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The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon.

April, 1919 Vol. 4 No. 4

EDITORIAL

THE POLITICAL SITUATION AND ITS EFFECT ON MOTORSHIP CONSTRUCTION

WHETHER the Republican filibusters were right or wrong in preventing passing of the Sundry Civil and Deficiency bills before the recent adjournment of Congress, or whether President Wilson was wise or unwise in returning to France without calling a special session of Congress, is not for us to discuss here, as such political comments do not come within the scope of this publication. But, unfortunately, the failure of the Naval Appropriation bill to pass has delayed the construction of at least one large Diesel-driven vessel.

So we have to seriously consider if the failure of the bills to pass will jeopardize or delay the present and future Federal shipbuilding programmes in so far as motorships are concerned. Not counting certain other engines there are, as is well-known, Diesel engines on order in the United States for at least 36 full-powered Federal motorships. Although work on some of these engines have been temporarily suspended, the hulls are now being designed—and the auxiliary engine-room machinery yet has to be ordered. The Deficiency bill contained $50,000,000.00 for the Shipping Board's present obligations, which sum now, of course, is not available. While the Sundry Civil bill provided for an appropriation of $650,000,000.00 of which part would have been immediately available had not Congress adjourned before the bill was passed.

The question is,—What will be done? Will Mr. E. N. Hurley, the Chairman, finance the present and future shipbuilding programmes, which we believe has the full support of President Wilson, or will all new constructions be temporarily suspended. The U. S. Emergency Fleet Corporation apparently has sufficient money to carry on until the end of June of this year.

Regarding the future constructional programme, and with regard to recent unpublished and prospective arrangements concerned therewith, we are to an extent obligated to remain silent, but we feel a little worried over the situation because not a few of the six-hundred-and-fifty-million dollars very likely will be used for building the fleet of 9800 tons merchant motorships outlined by Mr. J. H. Rosseter, Director-of-Operations, and possibly for converting many existing coal-fired steamships to oil-power. Therefore, it is to be hoped that either Mr. Hurley will be able to borrow half-a-billion or so, or else a special session of Congress be called by wireless from France, and the Sundry Civil bill passed.

Mr. Hurley has expressed the belief that it will be possible to obtain the needed money for carrying on construction until June 20th. Before the re-assembly of Congress Mr. Hurley will have completed his new programme and will place it before the country. We may add that a number of the strongest members of the Senate have recognized the value of motorships to the country and are very much in favor of motorship construction, and undoubtedly a large sum of money soon will be made available for that purpose.

THE VALUE OF EXTENDED DEVELOPMENT

EXPERIENCES of the past have shown that it is not good business for engineering concerns to undertake the construction of new and untried designs of marine Diesel engines of high power without the expenditure of a considerable amount of time and money in experimenting and developing before placing the finished product on the market. Where an engine is being built in good plants from some proven successful design and under expert supervision, these conditions do not apply and it may be considered quite sound and safe for the builder to offer the engine in ordinary commercial channels even before the patterns are made.

During the past few years not a little discredit has been thrown upon the domestic marine heavy-oil engine purely by indiscriminate and rash construction from untried "paper" designs, and there are even on record several instances where orders have been placed and accepted for engines totalling thousands of horse-power before the first engine ran its trials with results that could have been anticipated. In some cases success eventually resulted, but not before large amounts of money had been spent in alterations and repairs—or in other words—until the designers, builders, and owners all profited in knowledge by their experiences.

Europe also suffered from this sort of thing in the earliest days of the large Diesel-engines motorship, but there are always some of us who seem unable to profit by the lessons that have been taught others. Nevertheless, one or two severe blows have been given the American marine oil-engine industry merely through such causes as we have just commented upon. Such blows hit hard because some shipowners have not studied the motorship situation deeply enough to discriminate. But, when a man has lost money, the drain on his pocket usually makes him too sore, or too disgusted to discriminate and view the matter in an impartial light.

The United States is a big country, and with the future motorship building programme before us there is room for plenty of good oil-engine builders. In fact, fair competition among manufacturers always produces business that otherwise would not exist, so additional competition will benefit the industry.

(Continued on following page)

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But, to those engineering companies who have a tendency to regard the designing of a marine-type of heavy-oil engine as a simple matter,—even if they are experienced in steam engine design,—we would suggest a close study of the British Admiralty reports of the tests of the White Diesel engines in our last issue.

Here we have the case of two engines built by engineers of the highest reputation for good workmanship and careful design. In the test-shops these engines gave splendid results and ran 96 hour and 48 hour trials without an atom of trouble worth remarking about. Then they were placed in the ship. From that moment the reports show that a hundred-and-one troubles developed—all apparently unexplainable as to why they should occur **only after installation in the ship.** Luckily the builders were experienced in marine oil-engine construction and so were able to adjust each as it arose so that it did not occur again, so that the sea trials proved successful and we believe that the ship has since been very reliable in operation.

In quoting this particular case, we do not intend to convey the impression that new engines had been built without proper experimenting, as the reverse is actually the case; but we quote the same because it so well illustrates the little troubles that sometimes do arise after the engines are installed in the ship, of which no signs become revealed while the engines are on the test bed in the builder's plant. This is particularly applicable to new designs of marine engines in connection with which sufficient operation under ordinary sea-going conditions have not previously been obtained by the designers, as it is very necessary for the designers to be familiar with the requirements and conditions of marine service to assure of immediate success. Consequently, firms without such experience and who desire to produce their own engine should bear in mind the importance of extended experimenting and development before entering the market.

Motorships of New U.S.A. Merchant Shipbuilding Program

Thirteen-Knot Vessels of 9,800 Tons D.W.

ACCORDING to Mr. J. H. Rosseter Director of Operations of the U. S. Shipping Board, the general dimensions of the Diesel-driven steel merchant cargo-carrying motorship of the forthcoming continuation of the Federal shipbuilding programme will have the following dimensions:

Dead-Weight-Capacity	9,800 tons
Loaded Speed	13 knots
Power	4,000 b.h.p.
Type of Power	Four-Cycle Diesel Engines
Number of Screws	Twin
Length O. A.	440 ft.
Length B. P.	425 ft.
Breadth	56 ft.
Depth	38 ft.
Draught	26 ft.
Cruising Radius	28,500 sea-miles
Number of Cylinders per Engine	Six

These vessels will have three decks and will be of the shelter deck class. It will be noticed that their bunker capacity will allow of a voyage round the world on one load of oil-fuel. If one of the vessels made a voyage of 28,500 nautical miles without a stop at full speed she would complete the same in 91½ days on a consumption of but 1,555 tons of oil-fuel.

This is based on the assumption that each vessel is of 4,000 shaft h.p., as with this power the daily fuel-consumption would be about 17 tons, or 105 barrels, of oil.

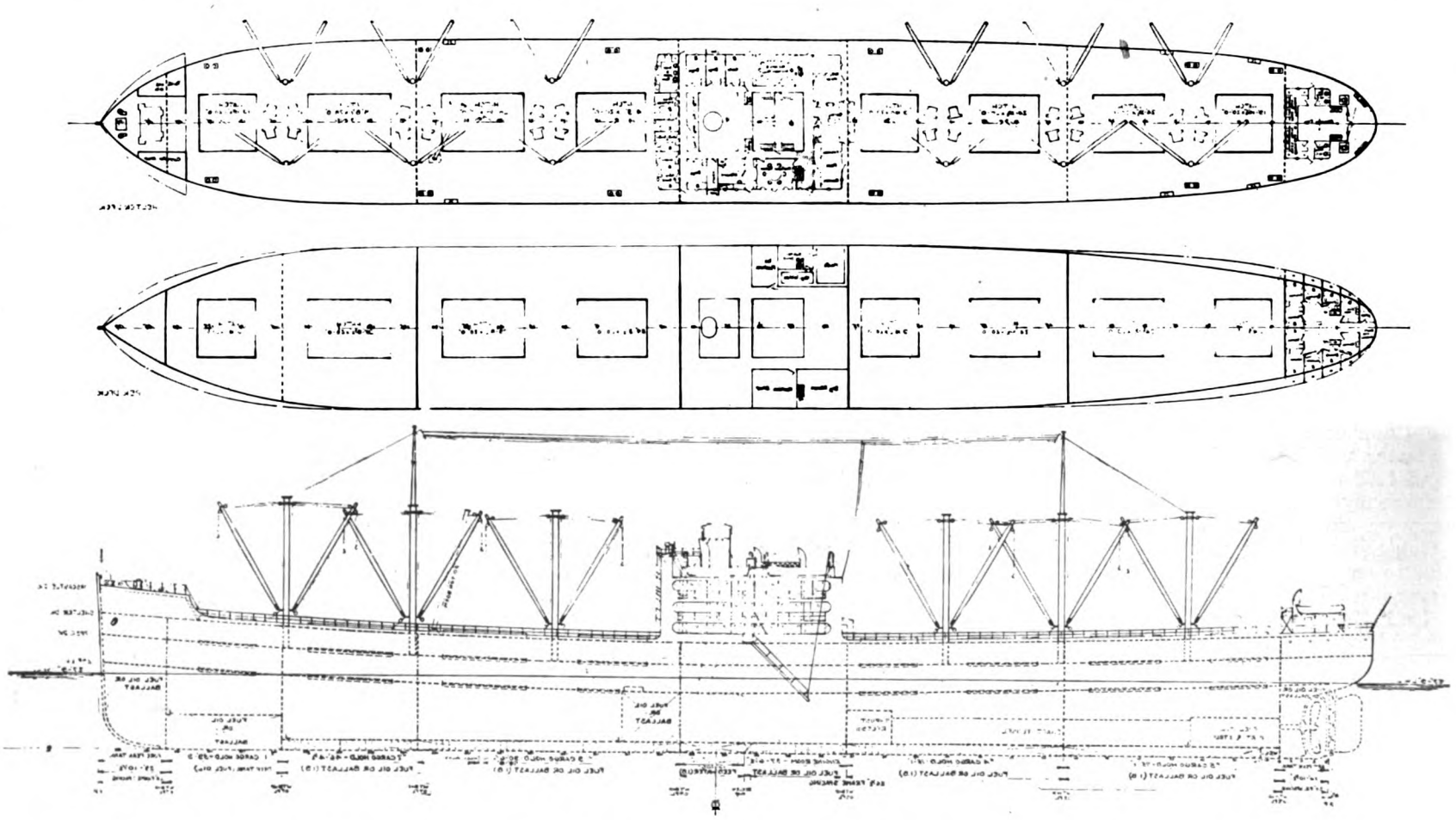
The overall dimensions of the above ship are the same as those of the Swedish motorship "Bullaren" described in "Motorship" of January, February and March, 1919; but the "Bullaren" is equipped with 4,000 I.H.P. and with a bunker capacity of 1,300 tons has a cruising-radius of 21,800 nautical-miles at 13 knots speed.

We note that the proposed American vessels, according to Mr. Rosseter, will be installed with 4,000 b.h.p., which is equivalent to about 5,200 I.H.P. This should result in a loaded-speed of 13½ knots in which case our ships will be a little superior in earning power to the Swedish vessels, yet will have a consumption of but 5 tons more fuel daily. Personally we think that Mr. Rosseter means a total of 4,000 I.H.P., in which case the daily-consumption loaded and at full-speed will be 13 tons.

Mr. Rosseter also announced the other classes of cargo-ships to be built and all these will be fitted with reciprocating engines and oil-fired Scotch boilers, and none will have steam turbines.

In our opinion the size of motorship selected is a most excellent one, especially as smaller vessels are covered by the fleet of thirty-six 5,800 tons motor-freighters for which the Diesel engines are under construction. We suggest that one of the new large vessels be installed with oil-fired steam machinery in order that definite operating and maintenance comparisons can be obtained. This, in fact, is very important for more reasons than one.

At the same time we strongly recommend that the proposed programme can be greatly strengthened if Group 2 also are fitted with Diesel engines. This can be accomplished by taking the same size engines as those installed in the "Bullaren" and adding two more cylinders to each engine, as was done with the "Glenapp." Then we shall be in possession of a fleet of 12,500 tons d.w.c. motorships of 14 to 15 knots average loaded-speed.



Tentative plan of the 9,800 tons d.w.c. Diesel-driven freighters, of Class 4-A, forming one of the series of four classes of merchant ships under the U. S. Shipping Board's new constructional programme. We understand that Chairman Edward N. Hurley will make his announcement of the complete programme at the dinner of the National Marine League on March 27th.

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Gulf Trade Calls For Motorships

Prospects of a Steady Demand for Oil-Engined Auxiliary Sailing Vessels

By HARRY H. DUNN

[In the following article Mr Dunn refers to a large number of motor auxiliaries built in Gulf ports for the Italian government. These vessels, however, were constructed to the order of the Italo-American Navigation Company of Turin, Italy, a new company formed in July, 1917, with a paid-up capital of forty-million Lires (L.40,000,000). This great new shipowning company is in the market for steel motorships, so American marine motor builders will do well to communicate with them with a view to securing orders as soon as the U. S. Shipping Board lifts its ban.—EDITOR.]

RESULTING from the great world war the South has learned something new about ships and shipping. It has learned, for one thing, that its greatest field of commercial development lies in Latin-America; it has learned that it cannot overcome that long distance around Florida sufficiently to compete with Atlantic ports for trans-Atlantic trade; it has learned that in the republics to the south of the mouth of the Mississippi river are 90,000,000 people who, for lack of factories, must buy most of their manufactured necessities of life from some other country, so why not make it the United States?

Over and above all this, the South has learned that it is not dependent on steamships to handle that export and import trade with the lands of the sun below the great gulf. It has learned that the economical oil-engine is as good as or better than the steam-engine in this service, and one of the results of the Mississippi Valley Foreign Trade Convention, which attracted hundreds of delegates to New Orleans in January, was the outspoken demand of a majority of the members for motorships or big auxiliaries, driven by oil-engines in the building up of a merchant fleet for traffic with Mexico and both coasts of Central and South America.

Part of this lesson the South learned from Italy, that is, the part about the auxiliaries, for out of the pine forests of Louisiana since the war began have come some the biggest auxiliary-vessels ever built in the world, constructed by an Italian for the Italian government. The other part of the lesson, that which deals with motorships, the South learned from the successful operation of motor tankships by the Standard Oil Company from its storage plant at Baton Rouge, 80 miles up the river from New Orleans, and the good work of the motorship "San Ramon" in the mahogany importing trade of the Otis Manufacturing Company at New Orleans.

Auxiliaries using both gasoline and heavy-oil engines have been in use along the Gulf coast for a number of years, but all have been small, mainly schooners of not more than seven hundred tons, and usually carrying not more than two or three hundred tons. In the main, these auxiliaries have been in service between Mobile, Pensacola, Tampa and Key West and the Islands of the Caribbean Sea. Another class of auxiliaries, ranging from ten tons to 150 tons have been handling millions of dollars worth of shrimps, oysters and fish for the seafood packing plants of Biloxi and Gulfport, Miss., but these have been working mostly on inland waterways and on the sheltered bays of the coastal marshes, while the auxiliaries in use at the ports first named and and in the West Indies have been working on the open gulf.

Economy of operation of these boats, small number of men in the crew, their seaworthiness, and the small space occupied by their power plants in relation to tonnage, led several southern shipyards, when the war broke out, to turn their attention to the construction of improved auxiliaries. Most of these yards confined themselves to craft of from 800 to 1,500 tons, but Henry Piaggio, Italian vice-consul at Gulfport, Miss., obtained contracts from the Italian government (see editorial note) for the building of a number of oil-engined auxiliary barkentines, up to 3,600 tons dwc, larger even than the Ferris-type wooden steamers the U. S. Shipping Board was having constructed for use in Pershing's "bridge of ships."

At first, Mr. Piaggio started with the construction of motor auxiliary barkentines of 2,500 tons dwc, and these proved so successful—one of them having maintained an average speed of sixteen knots during one day while on a voyage across the Atlantic to Genoa and return— that he increased the size, and is now building thirty-six such ships, of an average tonnage of 3,500 tons dwc, for the Italian government and for private contracts. He organized the International Shipbuilding Company, especially to build these auxiliaries for the Italian government (see editorial note) during the war, and later took up the construction of wood and steel steamers as well at the yard at Pascagoula, Miss., the yards of the company at Orange and Beaumont, Texas, continuing to build the wooden auxiliary barkentines.

The Mississippi Shipbuilding Corporation at Biloxi, Miss.; the Gulfport Shipbuilding Company, at Gulfport, Miss.; the Clooney Construction Company, at Lake Charles, La., and a shipbuilding firm at Brunswick, Ga., began putting out schooners with oil and gasoline engines for use on the gulf. The harbors of Tampico and Vera Cruz and even La Ceiba and Puerto Cortez knew their keels, while they visited every harbor in the Caribbean Islands. But still these comparatively small auxiliaries were not large enough for the trade with the farther states of Central America, or with the larger ports of South America. The Honduran government sent a special agent, a former member of the nation's congress, to New Orleans, to see if it would be possible to charter or buy one or two of the big new auxiliaries for the transportation of cattle from Honduras to the United States, through the port of New Orleans, and to carry back manufactured products of the northern republic. He could not get the ships.

The port of Guaymas, Mexico, the only good harbor in the state of Sonora, where most of the coastwise trade and traffic with Lower California is carried by auxiliary schooners

The original motor auxiliary—a lumber and freight schooner at New Orleans, La. In these old boats gasolene and oil engines are being installed

Since that time, the field for this type of vessel has enormously increased because of increasing knowledge of the efficiency and value of the auxiliary barkentines in trans-Atlantic service. The war took from one corporation alone fourteen steamers which had been in Latin-American and New Orleans service, and from other firms it drew proportionally. These steamers have not been returned, and probably will not be back at their old work for a year or more to come.

Meanwhile, every southern port is reaching out for the commerce of Latin-America, in an effort to get before England and France have recovered sufficiently from the effects of the war to reach across the Atlantic and take what the Germans held so long,—the balance of trade with South America. This is the real reason for the calling of the trade conference in New Orleans in January, and this is the real reason for the demand for auxiliaries, the demand that southern shipyards, with millions of feet of yellow pine in the Louisiana forests behind them be not allowed to shut down when they complete such government contracts as they may have in hand. The large auxiliary is the ideal vessel for tropical trade, and the South has the lumber to build hundreds of them. These are the conditions in the greatest field for motorship building in the New World today, and one of the principal topics discussed at the foreign trade meeting in New Orleans was the formation of companies among exporters of the Mississippi Valley for the construction of such bottoms to handle Latin-American trade.

The government-operated barge line on the Mississippi river also has contributed not a little to the demand for and need of a merchant marine for the gulf. It enables the manufacturer in any of the towns of the valley as far up as St. Louis, to ship directly by water all the way to the foreign port to which his product is consigned, and to handle it as far as New Orleans or any other port along the gulf, at about 60 per cent of the rates the railroads would have exacted from him

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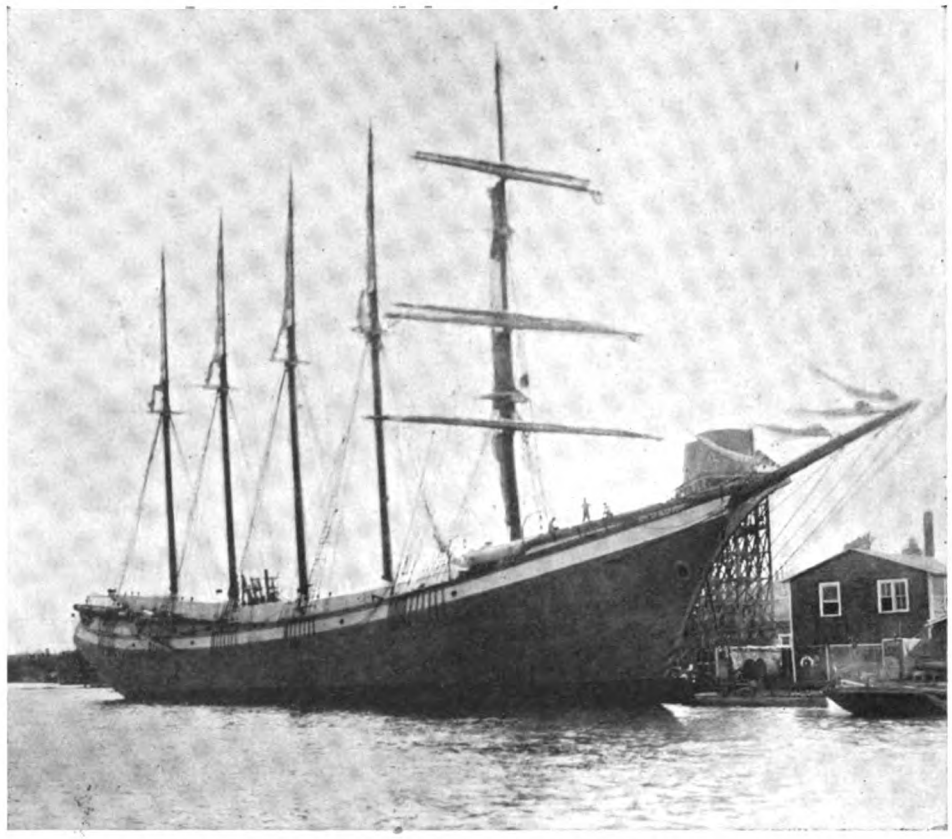
for the same service in the old days before the government took over the railroads.

Virtually every town touched by this barge line is developing its water-front facilities on the river and shipping all possible freight, both up and down-stream on the barges. Delivery of these barge cargoes either at shipside or on the wharves along the harbor, makes it cheaper and easier to operate even the small ship than it would if the inland products came in by rail, had to be re-handled by the Public Belt Railroad, which connects all the trunk lines with the wharves, and then loaded on board ship. Hence the availability of the smaller ship, which has the advantage of requiring much less time to build and of being much less expensive to operate than a steamer of the same size.

For some time several yards through Mississippi, Louisiana, Alabama, Florida, and eastern Texas, have been building large schooners for use in coastal and island trade and in fisheries. The fishermen were the first to learn the value of an engine in their schooners, and some of the owners of lumber schooners came next, so that these craft were the real pioneers of the big auxiliary fleet now being built, one here and two there, for use on the gulf. One of the first companies formed to build this class of boats was the Mississippi Shipbuilding Corporation, at Biloxi, Miss., which turned out "Gertrude A. Somerville," a three-master, and "Elizabeth Ruth," a four-master, both of which are now in service.

Both these boats are built entirely of long-leaf yellow pine and both are rated as A-1 for fifteen years. "Somerville" is of 1,200 tons deadweight and "Elizabeth Ruth" of 1,400 tons deadweight. J. W. Somerville, head of the corporation and actively in charge of the building of these ships, has also interested a number of members of the Southern Pine Association in the building of this type of vessel, and contracts for



A Fairbanks-Morse engined auxiliary sailing-ship built at the Orange yard of the International Shipbuilding Co.

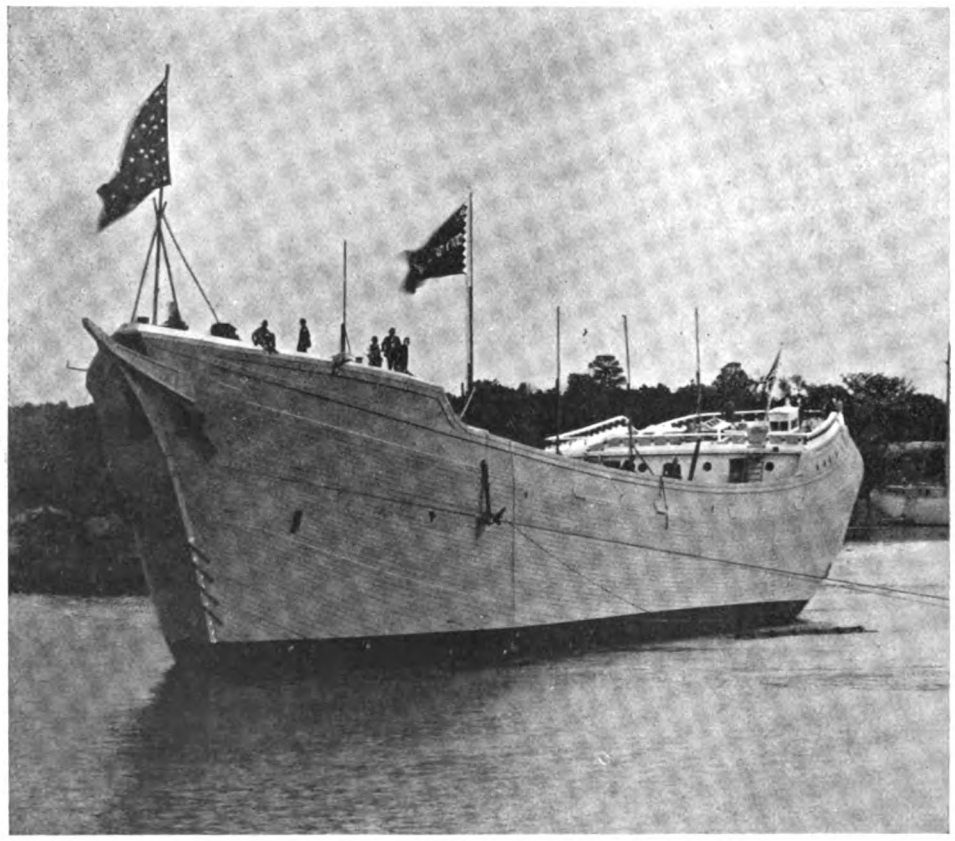
The oil-engined auxiliary "City of Gulfport," 3,600 tons d.w.c., built at Orange, Texas, for foreign owners

six other auxiliaries have been obtained by this firm. Each of the schooners already built has made voyages as far as South American ports without mishap, though the hurricanes on the gulf are among the heaviest of all sea storms.

Ferris-type steamers, Isherwood system tankers and big 5,000 ton Daugherty-type steam freighters have been built along the Gulf coast, the first named at several ports, the tankers at Violet, a suburb of New Orleans, and the larger ships by the National Shipbuilding Company at Orange, Texas, but none of them has aroused such interest as the big motor auxiliary barkentines built by the International Shipbuilding company. Shippers and ship-owners of both Americas have been interested in them and have sent men to see their performances and study their building. In short, they have formed a new type of freight carrying ship, devised as the result of the work for the smaller auxiliaries on the gulf, and found to be exactly what the trade demanded, not only on the gulf but for certain classes of freight across the Atlantic.

Built of the barkentine type, with the high bow and transome stern, with long wide hatches in between their four and five masts, these freighters have added a new form of shipping to the American merchant marine. The idea for these vessels came to Mr. Piaggio one day about two years ago, as he sat in his office as Italian vice-consul at Gulfport, Miss., and saw an auxiliary fishing schooner of large size slipping along against wind and tide, up Mississippi Sound. He looked up the records of these boats at the offices of the shrimp and oyster packers in Biloxi and Gulfand asked himself: "If these small auxiliaries pay, why should not larger boats of the same size bring big profits in the war?"

Then he laid his idea before the marine bureau of the Italian government, with the result that he received an order to build several of the auxiliary barkentines for that government. He



One of the Piaggio-built motor-auxiliary sailing-ships just after her launching at Orange, Texas

established a yard at Beaumont, Texas, then one at Orange, Texas, both of which have since been consolidated. He commenced work on 2,500-ton barkentines, and the first was a success, so was the second, and then he opened a large yard for the construction of wood and steel steamers at Pascagoula, Miss., and this venture also proved a success. Every bit of wood that went into the auxiliaries came from Louisiana. Frames of oak, sheating of pine, finishings of cypress, with masts from the taller pines of the highlands of Northern Louisiana. Only the machinery and the ropes came from outside the state. Surface-ignition and Diesel oil engines were the type finally hit upon, and they apparently have given good service, for contracts have been signed (as mentioned) for the construction of 36 more of these auxiliaries, for government and private contract. In the June issue of "Motorship" there were some excellent illustrations of this shipyard.

The use of auxiliaries has been established for

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some years in Latin-America, where the author has lived for a number of years. In the ports of Guaymas, Mazatlan, Manzanillo, Acapulco and Salina Cruz, on the west coast of Mexico, the auxiliary—small in size, but serviceable—are the most familiar boats in the harbors. Commerce between the Caribbean Islands is almost entirely carried on by auxiliaries, which are gradually replacing the coasting steamers because they are less expensive in operation, require smaller crews and make as good time as the steamers. The sponge-fishers who go out of Tarpon Springs, Florida, who have used schooners from the time they established their industry there, are now installing gasoline and oil engines in virtually all their boats. On the east coast of Mexico and on down through Central America, the fisheries, which are extensive from every port, use auxiliaries or power boats, with heavy-duty motors, and very seldom is it that one hears of one of these boats being lost, despite the terrific storms that rage over this part of the Gulf of Mexico and the open coast of the Atlantic.

The pearl fisheries of La Paz, Lower California, among the largest in the world, could not exist without the use of the gasoline or the oil engine in their schooners. On the rivers and bays of Central and South America, the auxiliary is replacing the small steamer, though in those countries the steamers die slowly because they burn wood, and wood is the cheapest commodity in that part of the world.

At present there is a plan on foot, fathered by the Carranza government of Mexico, to establish lines of large auxiliaries, of the type of those being built on the gulf coast of the United States, between the various countries of Central and South America, with Mexico included, to carry freight to the Isthmus of Tehuantepec, and there ship it back and forth on the Tehuantepec railroad, which is owned by the Mexican government, to be picked up at either side and distributed as return cargoes by the auxiliaries. There is a large service of auxiliaries even now, between Salina Cruz, the west coast terminus of the Tehuantepec railroad, and ports of Central America, while Puerto Mexico (old Coatzacoalcos), the east coast terminus, receives much of its merchandise by this type of vessel. The Latin-American of the coast, who is a natural boatman, seems to be able to handle the auxiliary to greater advantage than he can either the steamer or the motor freighter and the cost of construction is considerably less.

And there is great opportunity for the builder of auxiliaries, and the owner of them as well, in the ports all around the gulf, from the Isthmus of Panama, clear up the coast through all southern ports of the United States, around to Florida, where Tampa has been seeking a plant for the building of these boats for some years. At New Orleans, an Industrial Canal, bisecting the city, is being constructed at a cost of $25,000,000, and when completed, will offer quiet water sites for yards which will be ideal for this type of ship, with outlets to the gulf through Lake Pontchartrain, and into the Mississippi river at New Orleans.

Mobile, with her barge line service up the Mobile and Warrior and Tombigbee rivers into the heart of the Alabama coal and iron mining district, has deep water in many parts of the great bay, with abundant forests of pine and oak for the hulls, presents places for the establishment of such yards as good as those at New Orleans.

Tampico, Mexico, whose harbor is the mouth of the Panuco river, navigable for 150 miles inland, could be made the shipbuilding center of all Mexico, equipped as that port is with rail connection with the coal fields of the state of Coahuila and the iron mines and steel mills of Monterey, in the state of Nuevo Leon. All the Gulf of Mexico countries, and all those of Central and South America need only ships for their development, and the auxiliary barkentine, as developed in Louisiana and Texas, and Mississippi, seems to be the answer to that call.

Interesting News and Notes from Everywhere

NORWEGIAN FISH-CARRYING MOTORSHIP OF 500 TONS

The "Noatun," a 500 ton motor-auxiliary sailing-vessel, has been launched by the Skrubben Skibsbyggen at Kragero, Norway. The engine is a 160 B.H.P. Bolinder of the surface-ignition type, and the vessel will be used in the fish-carrying trade.

"SILVESTRE," A CONCRETE MOTORSHIP

The fourth Fougner concrete motorship has run her trials at Moss, Norway. She was built for Mr. Magnus Blikstad and is named "Silvestre." Her tonnage is 220 tons d.w.c. and she is powered with a Tuxham surface-ignition oil-engine of 80-100 B.H.P. We understand that she will be employed in the Spanish coasting trade.

THE U. B. 64

One of the surrendered German costal submarines is the U. B. 64. She is armed with a 3.4 inch gun and is propelled on the surface by two six-cylinder, four-cycle type, direct-reversible M.A.N. Diesel engines of 500 B.H.P. each. A complete description of this vessel appears in "Marine Engineer and Naval Architect" of January, 1919.

GERMAN DIESEL-ENGINE WORKS MAKES PROFIT OF $2,307,540

The Augsburg Works of the M. A. N., which are Germany's largest Diesel-engine builders have just made a profit of $2,307,540. Their capital is $9,000,000.

Another Diesel-engine works, namely The Deutz Co. of Cologne, have earned $2,221,085 for the year 1917 to 1918. The net profit amounted to $1,018,720.

CURRENT REVIEWS

Diesel Engine Design, by E. Mortimer Rose. Published by Emmott & Co., Manchester, England. At last the British censor has allowed this useful book to come into the United States. Why it was previously withheld from this country is hard to say, but the ways of censors are strange. From a Diesel engine designer's point of view this is one of the most valuable books on the subject yet published. It is, of course, highly technical, and deals extensively with the work of designing the various parts of Diesel engines and air-compressors. It is profusely illustrated with excellent drawings.

We recommend this book to every marine oil-engine draughtsman and designer. "Motorship" has received a limited number of copies from the publishers and can supply the same at $3.00 each, including postage.

ANOTHER DANISH MOTORSHIP

There was recently launched at Copenhagen the large motorship "Asia" to the order of the East Asiatic Co. On the same building slip there has been laid down another motorship of 12,000 tons d.w.c., which will be fitted with Diesel engines of 6,000 I.H.P.

DANISH AUXILIARIES FOR BALTIC

Several 600 tons d.w.c. auxiliary motorships have been purchased by the Det. Forenede Bogser Selskab of Copenhagen, Denmark, who are about to increase their capital to $2,750,000. The present capital is $825,000,000, and their vessels operate in the Baltic.

DUTCH AUXILIARY SCHOONER

In Scandinavia and Holland dozens of small steel motor-auxiliary schooners are completed every few months. Among them may be mentioned the "Europa," a two-masted vessel of 150 tons gross built for North Sea and Baltic coastwise trading, by I. J. Bodcaes, of Pannerden, Holland, which made her trial on 19th December last.

LICENSES AVAILABLE FOR SMALL DIESEL ENGINE

During the last five to six years the Fulton Manufacturing Co. of Erie, Pa. have been engaged in developing a small marine Diesel engine of the four-cycle type with not a little success, this engine having been adopted by the U. S. War Department. The first engine which they built was a 50 H.P. unit and was installed in a tug about five years ago by the Maryland (Sparrow's Point) plant of the Bethlehem Shipbuilding Co. Another engine was installed in a tug owned by the United Fruit Co. which has given most satisfactory service.

Now that this Diesel engine has attained commercial success and has demonstrated its reliability, the builders are prepared to dispose of the design and exclusive manufacturing rights for various countries. The engine is of ideal size for fishing vessels, tugs, general work-boats, or for engine-room auxiliary power for large motor-vessels, and its design allows of moderate constructional costs. This is an excellent opportunity for some enterprising concern to obtain a good engine design at moderate cost.

SWEDISH MOTORSHIP "BALBOA"

The new 13-knot 9,400 tons Swedish motorship "Balboa" has been launched at the Gotaverken, Gothenberg, Sweden. This makes the fourth large motor-vessel turned out at this yard, the others being the "Hamlet," "Bullaren," and "Tisnaren."

FINNISH MOTOR AUXILIARIES

Wooden motor-auxiliary sailing-vessels up to 500 tons are being built at the yard of the Alands Vargs och Rederi A/S, Sviby, Aland Islands, Finland. Other shipyards in the above islands also are building motor auxiliaries.

DIESEL TO STEAM AND BACK TO DIESEL POWER

About a year ago the motor tanker "Emanuel Nobel" cracked her crankshafts, and we understand that owing to the difficulty of obtaining new crankshafts at that time, her Werkspoor-Diesel engines were removed and replaced with steam engines, as the latter were available quicker than new crankshafts. However, her Belgian owners have decided to remove the steam-machinery and install new Werkspoor-Diesel engines. Her old Diesel engines now are lying at the Sun Shipyard, Chester, Pa., but the representatives of the owners are asking more than three times their original cost, not including new crankshafts that have since been made.

OPERATION OF SULZER-ENGINED MOTORSHIP

In the 22nd February, 1919 issue of "Le Moniteur De La Flotte" of Paris, France, the following interesting comments appear: "Since there are building more and more cargo-ships with motors, it is interesting to mention the excellent results obtained since 1912, on board the motorship 'Monte-Penedo' which has been navigating for several months past under the name of 'Sabara.' This vessel of 7,000 tons capacity has been docked at Marseilles and is open for inspection, having just completed a voyage from Rio de Janerio. She is propelled by two motors of the Sulzer-Diesel type of 1,100 horsepower each. She has been operating for the past six months with the best results."

"During the past month there arrived at Havre, coming also from Brazil, the auxiliary 'Itamaraca' of 2,300 tons which is also equipped with two motors of the Sulzer-Diesel type of 350 b.h.p. each. This boat has been giving complete satisfaction since 1916."

The Admiral's barge attached to the U. S. S. "Mississippi," a fifty-footer, used for proceeding from warship to warship, etc. She is driven by two 65 h.p. Sterling gasoline engines

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A Great American Marine Diesel-Engine Plant

History and Works of the New London Ship & Engine Company, Groton, Conn.

Builders of the Nelseco Heavy-Oil Motor

[In a little town not much over a hundred miles from New York City there has developed during the last half-dozen years a very important marine Diesel engine-building plant; but, owing to the war, its maximum energies have been devoted to the naval phase of the industry, with the result that comparatively few shipowners are aware of the vast output facilities of this concern or of the commercial Diesel engine work previously completed. Now that urgent war constructions have eased down, and that the veil of secrecy can be withdrawn, we feel the time has come to properly show that these works may become of great importance in connection with the production of propelling machinery for America's merchant motorship marine. Undoubtedly the New London Ship & Engine Company has one of the best Diesel engine building plants in the country, the facilities of which will be increased when the proposed extensions and additions to equipment are made. Their re-entry into the commercial field also makes interesting our references to merchant vessel installations that they have carried out from time to time.—EDITOR.]

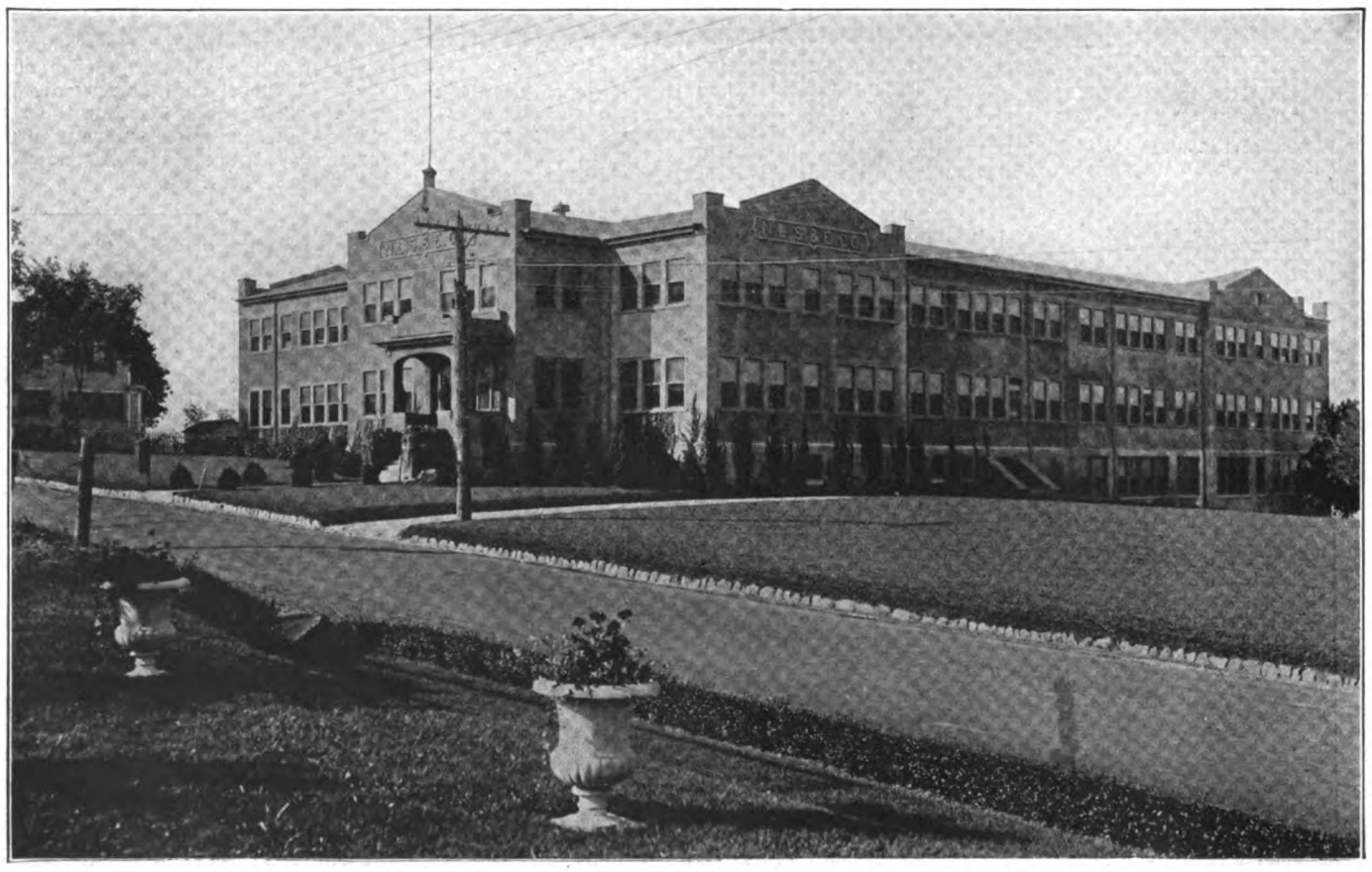
EXCEPT within a limited circle it is not known that the New London Ship & Engine Company was the first domestic builder of marine Diesel engines, and is today one of the biggest and most important builders of these machines in the United States of America. The history of the organization and growth of this company has plenty of general interest because it is intimately connected with the development of the submarine, and also because the company was the pioneer in this country in connection with marine Diesel engines. The Diesel-driven submarine was certainly one of the most interesting elements in the recent war; but, unfortunately, our enemies used it for commerce destroying, whereas in America the Diesel engine now promises to be, if it is not already, the most valuable machine connected with peace development following the war, because it will enable the "Stars and Stripes" to float over a great and successful merchant marine.

The above company dates back to October, 1910, when it was incorporated under the laws of the State of Connecticut and located at Groton, Connecticut. At that time, the Electric Boat Company was building submarines for the United States Navy. That is to say, it was building practically all of the few submarines which were appropriated for in those days. Because of the limited and uncertain amount of business that then was available, the Electric Boat Company found it preferable to build these submarines by sub-contracting with shipyards, rather than by investing a large sum of money in a shipyard and machine shops of its own; also the earlier submarines were fitted with gasoline engines which were built by the sub-contractors. But, when the Diesel type heavy-oil engine was developed for submarines in Europe, it became apparent that the best results could be obtained by building these heavy-oil engines in a modern engineering shop, especially equipped for the purpose, because the high-speed Diesel engine work was of such an exact and difficult nature that the ordinary machine shop of a shipyard could not be expected to cope with the task.

During that period the appropriations for the building of submarines were so small and business conditions were such that the Electric Boat Company alone would not have been justified in making the necessary investment for a suitable plant such as they now are associated with. Nor was there any direct assistance or encouragement offered or obtainable from the U. S. Government. It must be remembered that in those days the future of the marine Diesel engine was in considerable doubt, as it then was a new and untried machine in the United States. For these reasons, a great deal of credit should be given to certain officers of the Electric Boat Company for their initiative courage and enterprise in instigating and carrying through the organization of the New London Ship & Engine Company. These gentlemen staked their own personal resources and, in addition, went out and secured stock subscriptions under conditions whereof it was exceedingly difficult to raise funds for an enterprise of this nature.

It was largely due to their courage and faith in the proposition that the financial interests back of the Electric Boat Company were persuaded to do their part in subscribing for the amount of stock necessary to place this infant industry upon its feet. While some of the financial interests connected with the Electric Boat Company were in thorough sympathy with the proposition, they, at the outset, gravely doubted the ability of the initiators to raise the necessary funds at that particular time. However, after a few months of persevering work, the seemingly impossible feat was accomplished and the New London Ship & Engine Company was started on what has since proved to be a brilliant and successful career.

After making the necessary financial arrangements, the next problem was to secure a suitable location. An investigation was made of all available harbor sites on the Atlantic coast from the Delaware up to Bos-



The main office building. Here also are situated the drafting-rooms

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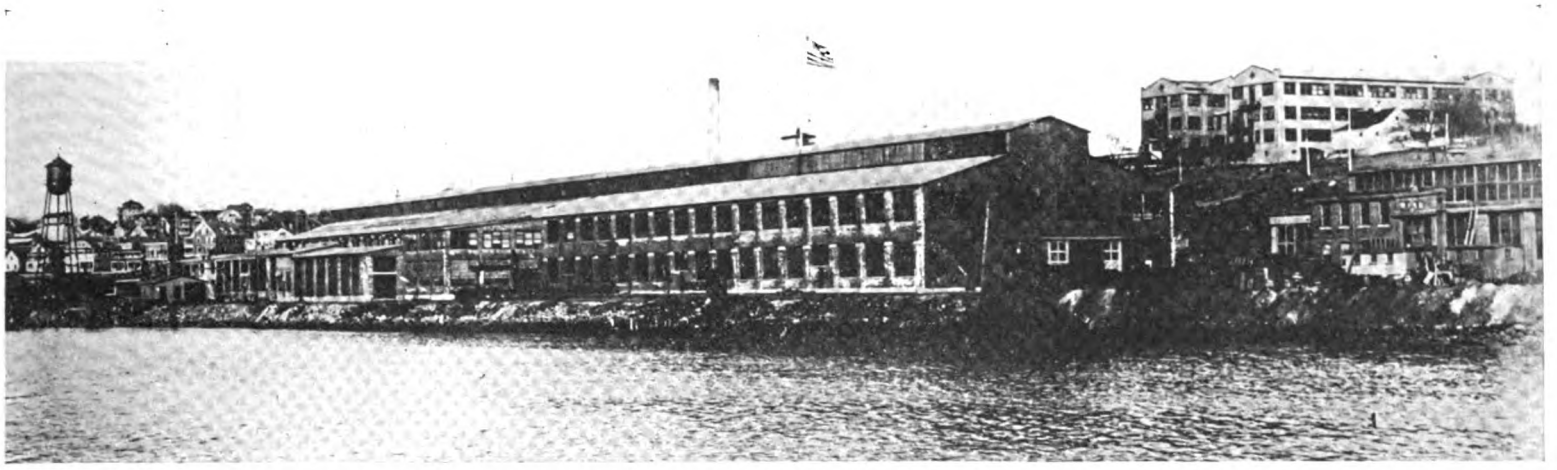

General view of the machine and erecting shops—the offices and drafting-rooms can be seen on the hill, and the foundry below on the right

ton. In making a selection of this kind there are many considerations, such as rail and water shipping facilities, depth of water in the harbor, labor markets, material markets, etc. No one location was found which fulfilled all these requirements 100 per cent.

But with an eye to future development, New London was finally selected, as it is located on one of the best harbors on the Atlantic coast and it is also about half way between Boston and New York, and therefore in fairly close touch with these two important commercial centers. The site selected is on the east bank of the Thames river in the town of Groton opposite the city of New London. This site had formerly been occupied by the Eastern Shipbuilding Company, which laid down and completed the two largest steamers ever constructed in the United States—namely, the "Minnesota" and the "North Dakota." When the New London Company started business in Groton this yard had been entirely dismantled, so that the ground was bare and ready for its new occupant.

The first buildings to be erected were sections of the machine shop and office building. Having faith in the future of the company, the officers adopted the most modern type of building for the machine shop, and so laid it out that extensions could be added from time to time as the business grew. This foresight

An air-compressor casting just removed from the mould. Note that it is quite an intricate casting

was well warranted because, while the original building was only 160 feet in length, the present machine shop alone is 720 feet, to say nothing of the additional buildings contingent thereto. A policy was adopted of installing only the latest and highest grade machine tools. This policy has since been adhered to, so that today the plant is one of the best equipped in the United States, if not in the world. The latest addition to the plant was begun in February, 1917, in anticipation of our entrance into the world war, and was completed about the day war was declared, much to the gratification of the U. S. Navy Department.

The plant today covers four and a half acres of land and has 320,000 square feet of covered floor space. It represents an investment of $1,385,000.00 in high-grade tools and equipment, and now employs 1,140 men. The maximum number employed during the height of the war was 1,600 men, and more could have been employed had it not been for the scarcity of labor.

Originally the company followed the practice adopted by many other domestic concerns of obtaining castings from outside foundries. This practice was found to be unsatisfactory for two reasons: first, because the nature of the Diesel engine work was not in line with the usual commercial foundry, and, secondly, because the U. S. Navy Department exacted a higher grade of material

The north section of the machine shop

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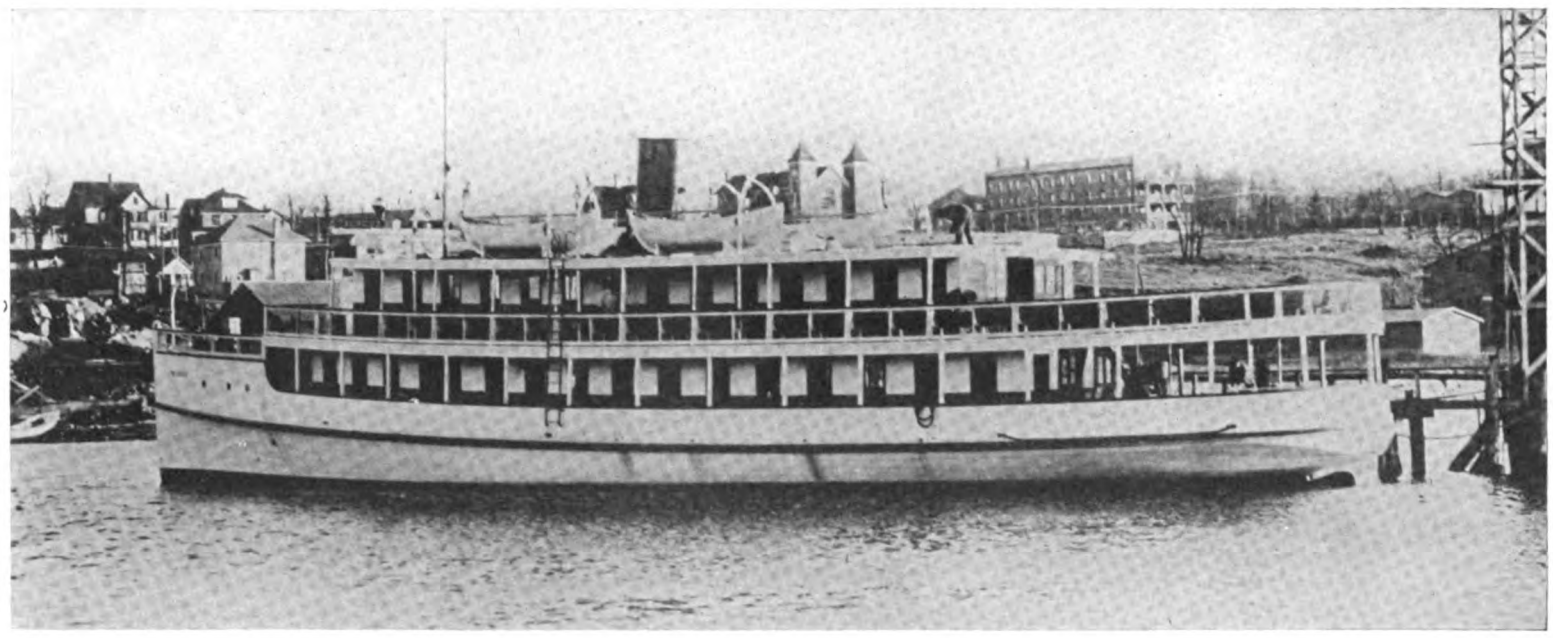


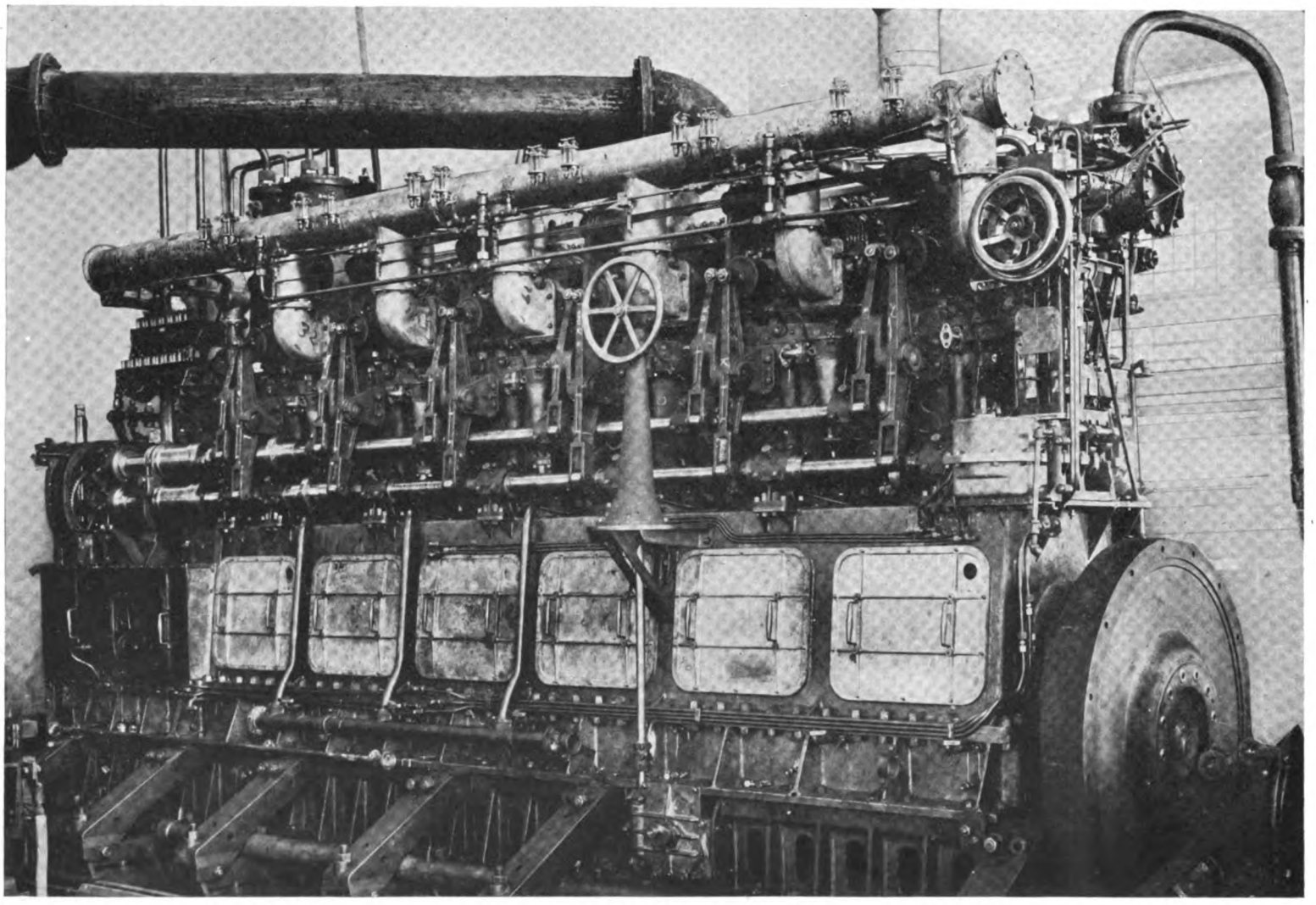
The Nelseco-Diesel engined ferry vessel "Nelseco II" in service on the river Thames at New London, Conn. She has been in daily operation for the past 18 months and has given splend.d service

than had heretofore ever been obtained in the United States; higher, in fact, than was absolutely necessary. When these requirements had been raised to a point where it became a physical impossibility to obtain castings from outside foundries, which would meet the specifications of the Navy Department, the company again took matters into its own hands, and without any assistance from the Government built its own iron foundry, using the most modern construction and equipment.

After consulting with the highest authorities on metallurgy, the firm engaged the services of a competent metallurgist and placed all technical matters pertaining to the foundry in his hands. The very best grades of material were procured, no means being spared to obtain the highest grade of product obtainable. This policy was well justified. Success was met with from the very first. Castings which were impossible to obtain from any source whatsoever were soon successfully produced in quantity. It was unquestionably due to this foundry that the company was able to carry on its war work uninterruptedly and on schedule time. In connection with the foundry there is a well-equipped laboratory.

A number of steel castings were used in the construction of the engines and so much trouble was experienced in obtaining from outside sources castings which would pass Government inspection that the company also started its own steel foundry, using an electric furnace. While the investment was considerable in comparison with the quantity of material required, this move was also well justified by results. Finally, a modern steel forge was added to the plant so that the company is today well rounded-out and self-contained.

The products of the company have consisted almost exclusively of Diesel engines, the only other products manufactured during the past eight years having been torpedo tubes, auxiliary machinery for submarines,



One of the latest designs of Nelseco four-cycle type Diesel engines of 1,000 B.H.P. at 375 R.P.M. It is direct-reversible

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America's first fleet-type submarine. She is propelled by four 1,000 B.H.P. Nelseco four-cycle Diesel engines

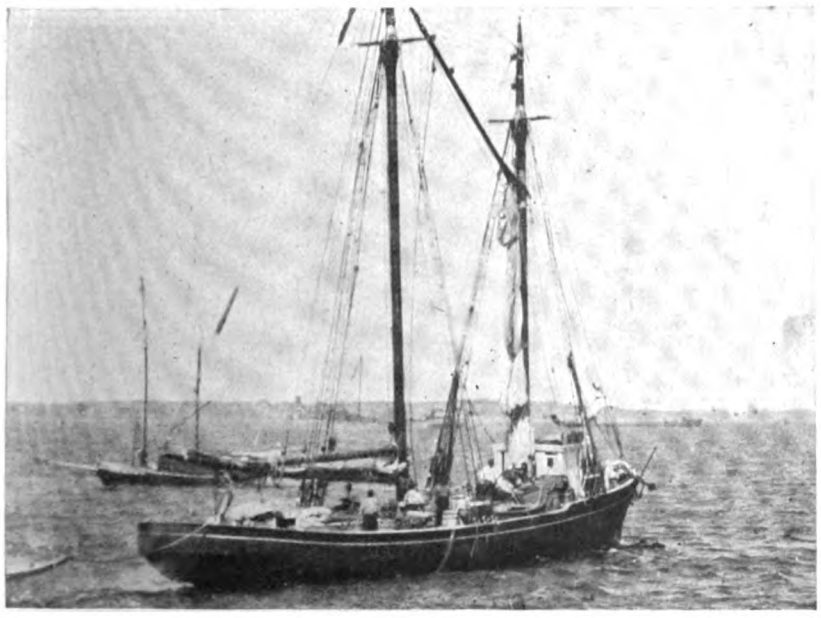
and some single-acting gasoline engines for submarine chasers.

When operations first began at New London, the two-cycle type of Diesel engine was constructed. The design of this engine was procured under a license from a European firm, but after a few years' experience with it, it became apparent to the engineering staff of the company that a much better design could be produced in the United States. Consequently, the company produced in 1913 its own design of four-cycle single-acting engine. The first engine built was of comparatively small size, being a four-cylinder developing 100 horse-power at 350 R.P.M. Few changes were found necessary in this engine, so that it was a success from the start and formed the basis for all the four-cycle engines manufactured since.

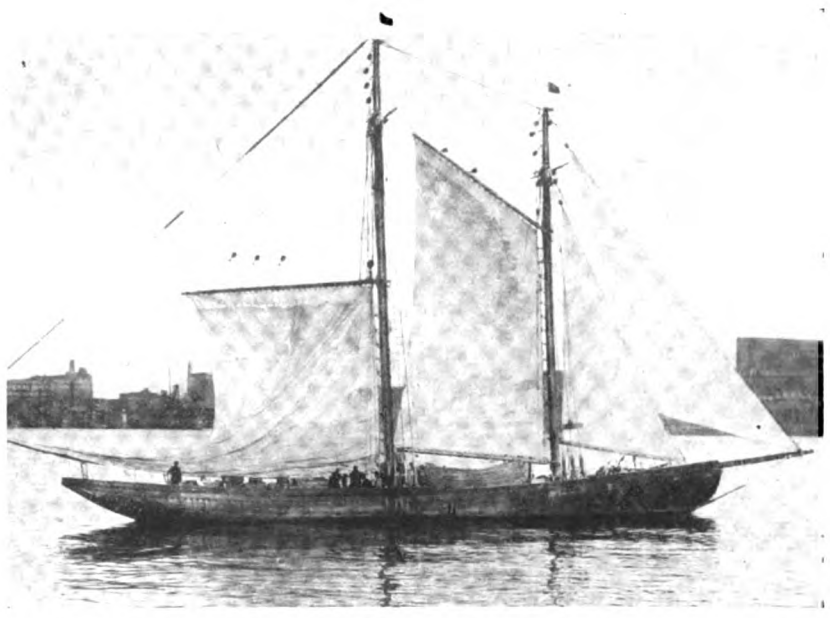
Soon after the outbreak of the European war, the Electric Boat Company was awarded a rush order for twenty submarines for Great Britain. It was decided to adopt the Nelseco design of four-cycle engine. Consequently forty engines, each of 240 horse-power in eight cylinders, were put in process and rushed through to completion in about six months, so that in the spring of 1915 they were installed in the submarines for which they were intended. The submarines cruised across the Atlantic under their own power and operated successfully throughout the European war. Many favorable reports have been received by the company in connection with the performance of these engines during the hardest war service imaginable. This experience was so satisfactory that the United States government also adopted this type of engine in the same size and in larger units. The largest size thus far built is the six-cylinder, 1,000 horse-power, running at 375 R.M.P., of which we give an illustration. Many engines of intermediate size have been produced. According to Jane's "Fighting Ships" for 1918-19, these submarines have been very successful and are very favorably regarded by the British submarine service.

The Nelseco Diesel engined submarine "Isaac Peral," built by the Fore River Plant of the Bethlehem Steel Co. for the Spanish Admiralty. Speed, 15.36 on surface. Displacement, 700 tons

During the latter half of its existence, the company has been busy on war work. This has naturally interfered with the commercial side of its business. In fact, during the period when the United States was engaged in the war, absolutely all work on merchant ship Diesel engines had to be stopped. But, even before the United States entered the war, the urgency of the demand for submarine engines was so great that the commercial field was comparatively neglected. It may be said that such commercial business as has been done was almost unsolicited, as the company was too busy with naval work to permit it to push the commercial business in the manner it properly deserved. In spite of this, quite a number of commercial Diesel marine engines have been installed both on the Pacific and the Atlantic coast. That these installations have given a good account of themselves is a source of great satisfaction to the management and is a great promise for future developments. The following is a list



Auxiliary schooner "Francis S. Grueby," of Boston, Mass. 140 gross tons, 94 net tons, length 102.8, beam 23.2, depth 11.8, 120 b.h.p. Nelseco Diesel type heavy oil engine. Speed 8 knots. Fuel consumption 6¾ gals. per hour



Auxiliary fishing schooner "Lucia," of Gloucester, Mass. Owned by John Chesholm & Son. Length O. A. 99.6, beam 20.6, depth 9.6. 120 b.h.p. Nelseco Diesel engine. Speed 8-9 knots

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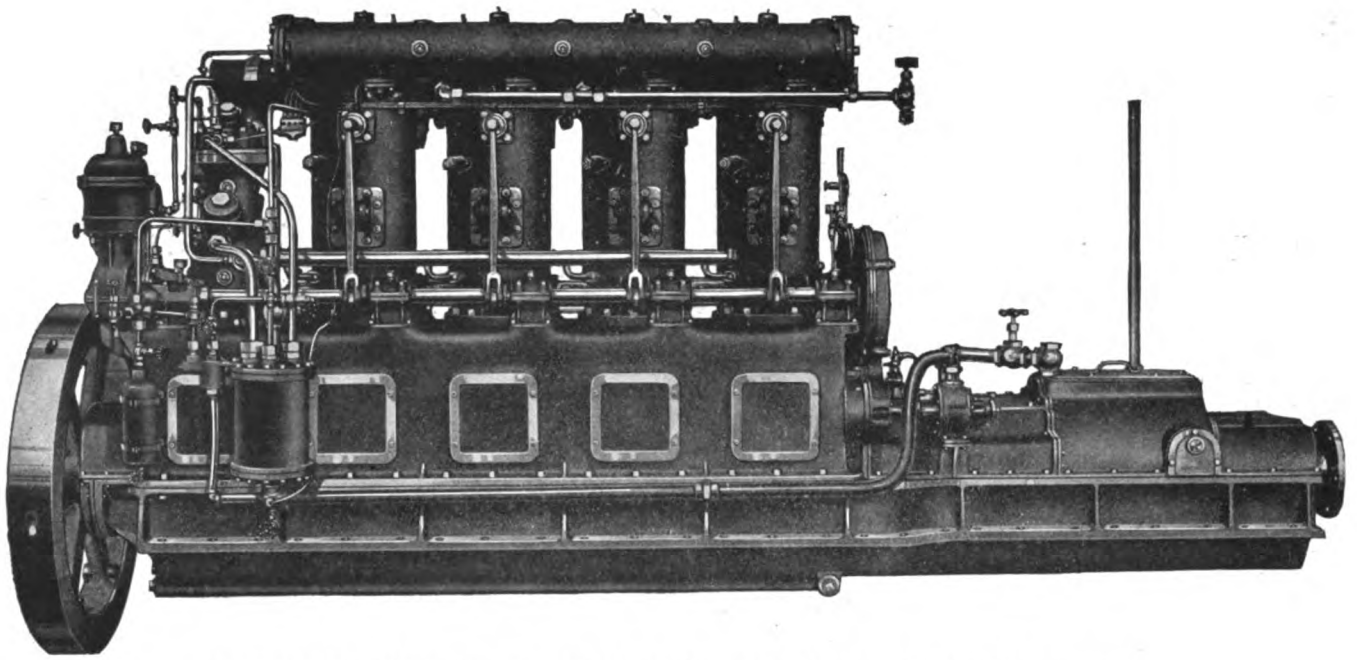


Exhaust side of the Nelseco four-cycle type 120 B.H.P. Diesel commercial marine engine. It turns at 350 R.P.M.

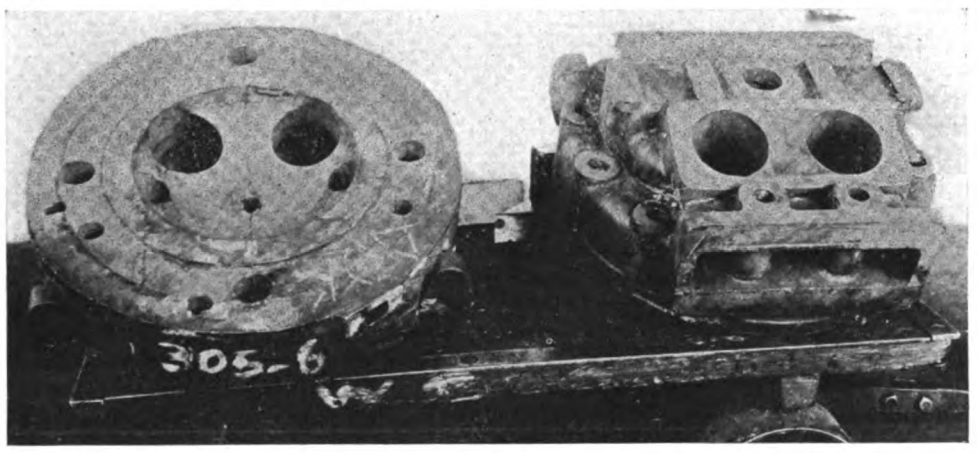
of engines which have been installed in commercial vessels during the past five years:

Two 60 horse-power engines.
Fourteen 120 horse-power engines.
Three 180 horse-power engines.
Five 240 horse-power engines.
Total—24 engines aggregating 3,540 b.h.p.

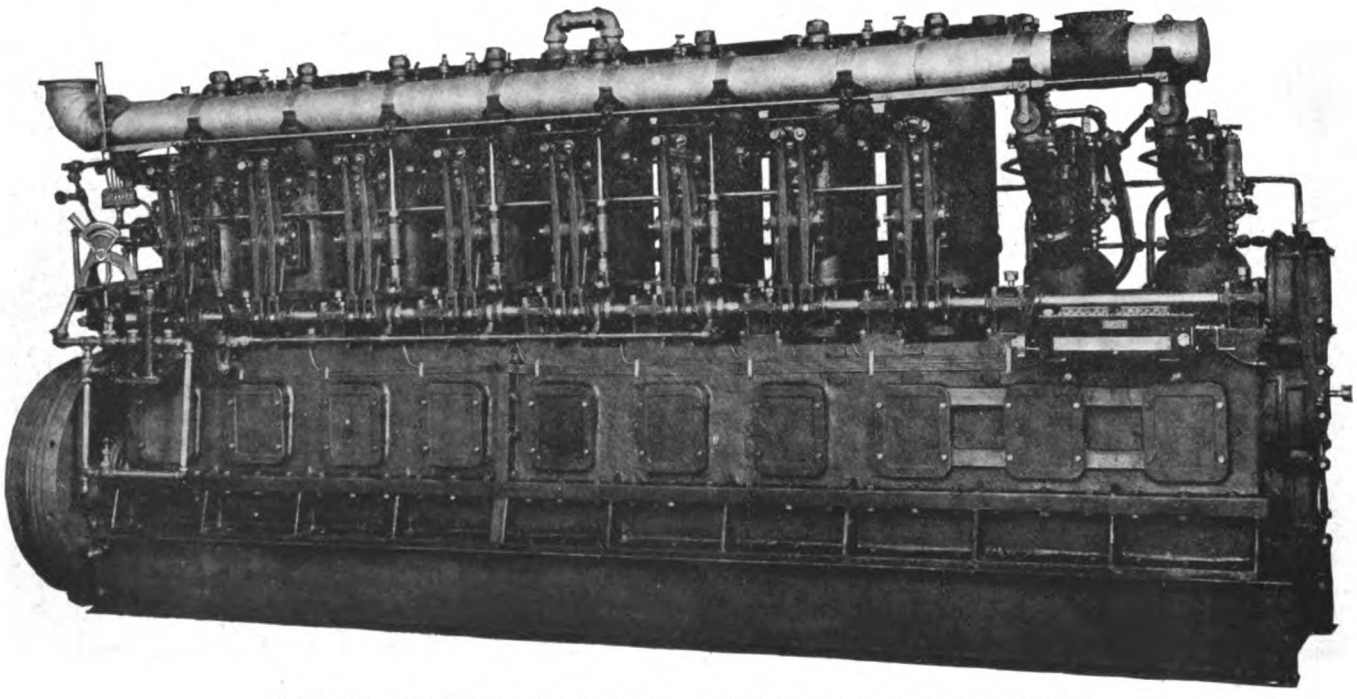
This list, of course, is insignificant in comparison with the number of engines which have been supplied for naval work. The output of the New London plant measured in horse-power has been as follows:

1912—450 horse-power.
1913—7,770 horse-power.
1914—9,990 horse-power
1915—17,490 horse-power.
1916—20,940 horse-power.
1917—30,460 horse-power.
1918—40,160 horse-power.
Total—117,260 horse-power.

Doubling the 1916 production last year is rather remarkable work, and indicates the excellent equipment of the plant. While the output of the company during the past five years has been practically limited to single-acting, four-cycle engines, interest has not been lost in other designs and possible future developments. In fact, the company advise us that they have thoroughly investigated every type of two-cycle and four-cycle engines, single and double acting. They already have had considerable experience with the two-cycle, moderate speed single-acting engine, such motors completed by them having a total of 23,100 brake horsepower. Designs have been prepared of two-cycle, double-acting engines. The company has also designed and built an experimental four-cycle, double-acting engine. This was a single-cylinder, high-speed unit, was run for a considerable time and the results obtained were considered highly satisfactory. It will interest engineers and others to learn that they now propose, in addition to this, to develop a two-cycle, double-acting marine engine. When this latter has been accomplished, this company will have then built practically every general type of Diesel engine which has ever been discussed with the exception of the Fullager, Junkers, and solid-injection design. We were advised that they are well aware of the never-ending discussion as to the relative merits of the two-cycle and four-cycle engines, and that their selection of the four-cycle engine for their present output was decided by practical experience. Their own investigations showed that after all there was not a great difference which type was built,



Two cylinder-head castings of a large Nelseco Diesel marine engine



A 240 b.h.p. 8-cylinder, four-cycle Nelseco Diesel-type commercial marine-engine

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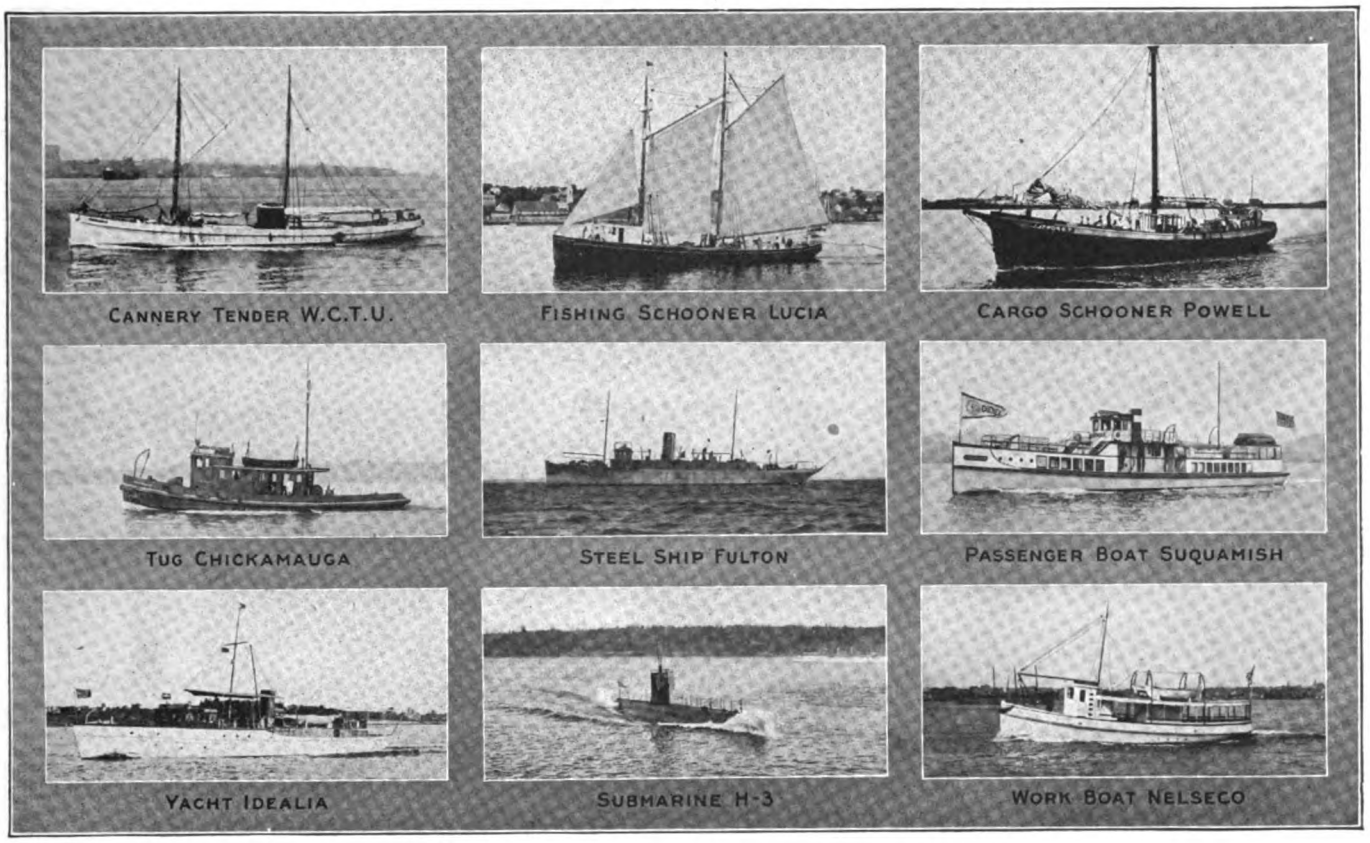


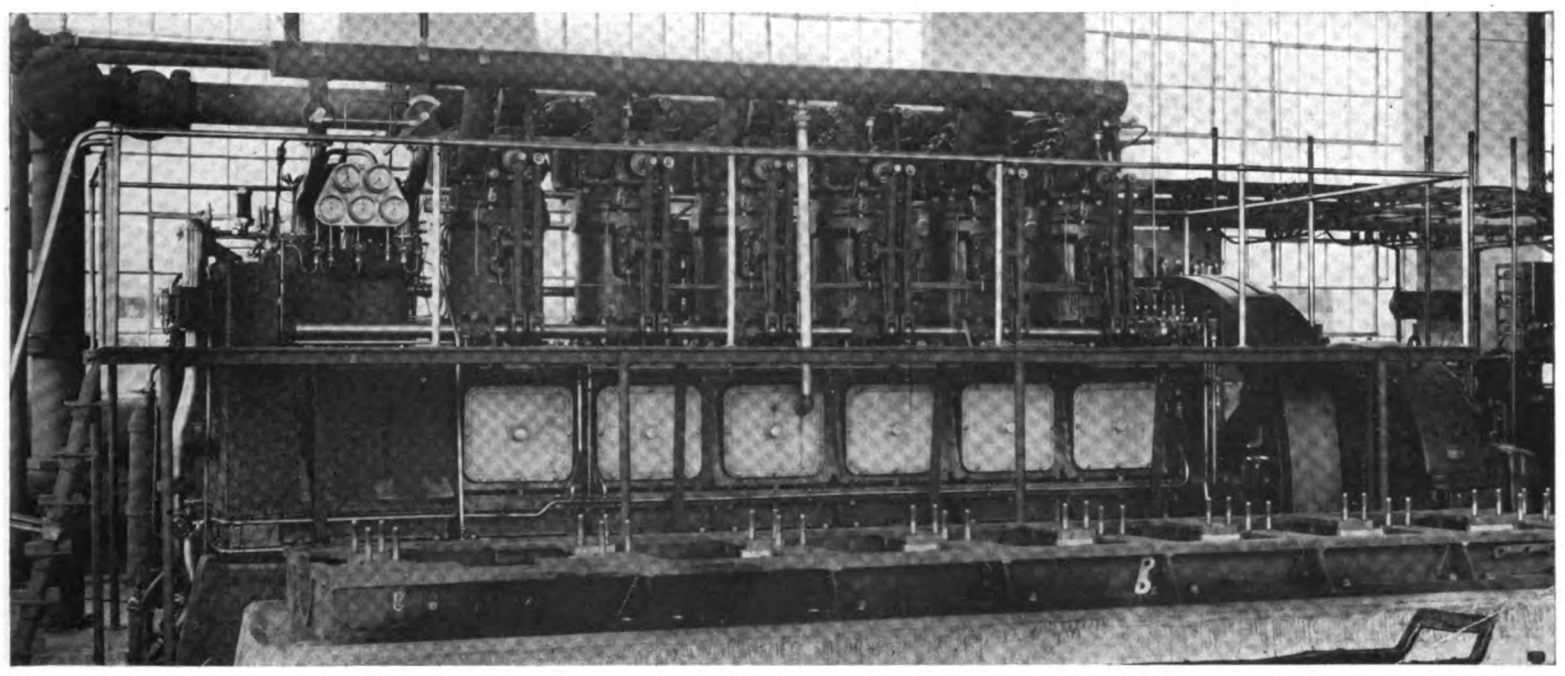
Various commercial, naval and pleasure vessels equipped with Nelseco-Diesel engines

as each type had so many advantages and disadvantages peculiar to itself. But such slight difference as there was appeared to be in favor of the four-cycle engine.

As the plant was erected primarily for the building of engines for submarines and for the smaller class of commercial vessels, the product up to the present time has been limited to engines falling within these classes, the largest engines, as before stated, being 1,000 shaft horse-power in six cylinders. Now that the mercantile marine industry of the United States realizes the great advantage of Diesel oil-engines, and recognizes that such engines are absolutely necessary if our merchant marine is to compete with foreign ships, the company has in view plans for the construction of the largest sizes of Diesel engines for big steel ships. There are, of course, certain physical limitations to the size in which Diesel engines can be built, for many years yet. When it comes to powering such vessels, as battleships, battle-cruisers, and trans-Atlantic liners, where the power ranges from 20,000 h.p. to 125,000 h.p., some other expedient than direct propeller-drive seems to be necessary. For such installations, electric transmission of the power at once recommends itself.

Our latest dreadnoughts are already equipped with electric drive. If Diesel engines and generators be substituted for the boilers and turbines, these battleships could be given as much power as they now have with steam and would have the advantage of using only one-third the amount of fuel now required. This saving in fuel would not only reduce operating costs, but would also enable the ships to have a much greater cruising radius, a heavier armament, better protection, or a combination of these three additional advantages. If this system of propulsion be applied to a trans-Atlantic liner, not only would the saving in fuel be enormous, but the engine-room crew could be reduced to a minimum, and the ship would be able to carry a greater weight of cargo on account of the saving in fuel. The present shops of the New London Ship & Engine Company are in excellent condition to undertake the manufacture of engines suitable for such work as that above described.

Not long ago a naval officer, in a position to know whereof he spoke, remarked to one of the officers of the company that he considered its New London plant one of the greatest assets the U. S. Navy had during the war. It was, in fact, with the exception of one small works, the only plant on the Atlantic coast engaged in the building of engines for submarines, and in a position to furnish spare parts for the submarines in service during the war. Although such an



In view of the possibilities of Diesel electric drive for merchant ships, this Nelseco Diesel-electric generating-set is of interest

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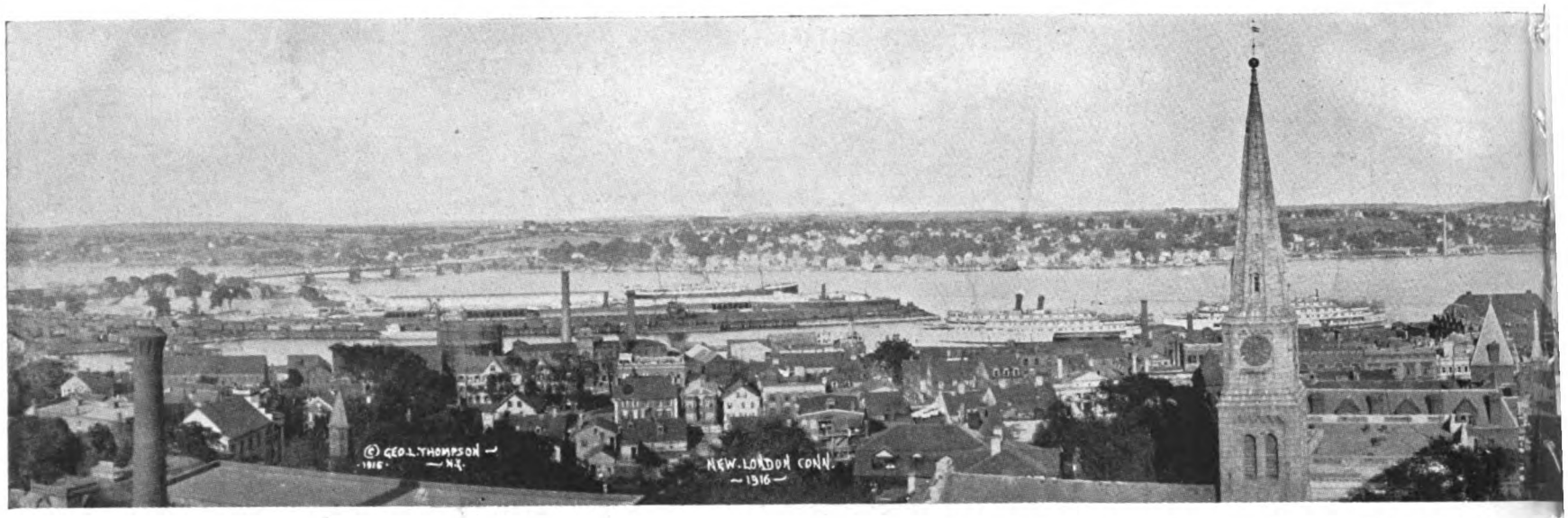


General view of New London, Conn., and its splendid harbor. The plant o

asset to the country, the company did not make nor receive any direct assistance from the Government. Such extensions as it made were paid for entirely with its own money, although at the time hundreds of millions, even billions, of the Government's money was being distributed broadcast for the erection of shipyards, ammunition plants, etc. This leaves the company on the event of peace without obligations, and if it should turn out as intimated that submarines are to be abolished by the peace conference, the company will not be disappointed, as it feels that it can serve an equally useful purpose by building Diesel oil-engines for our merchant marine. If, on the other hand, a national emergency should again arise, the company can devote its energies to the manufacture of submarine engines and thus continue being a national asset.

The plant of the New London Ship & Engine Company has all the essential elements and building necessary for constructing complete internal-combustion engines. As previously mentioned, this plant was built especially for these requirements and the general layout and equipment were chosen with the special features of the case in view.

One very important point kept in mind in the planning of all the shop buildings was to provide ample light and ventilation, these requirements being just as essential for the production of good work as the provision of proper machine tools. Results obtained amply justify the care and pains taken in this regard, and the well-lighted effect obtained has often been remarked upon by visitors.

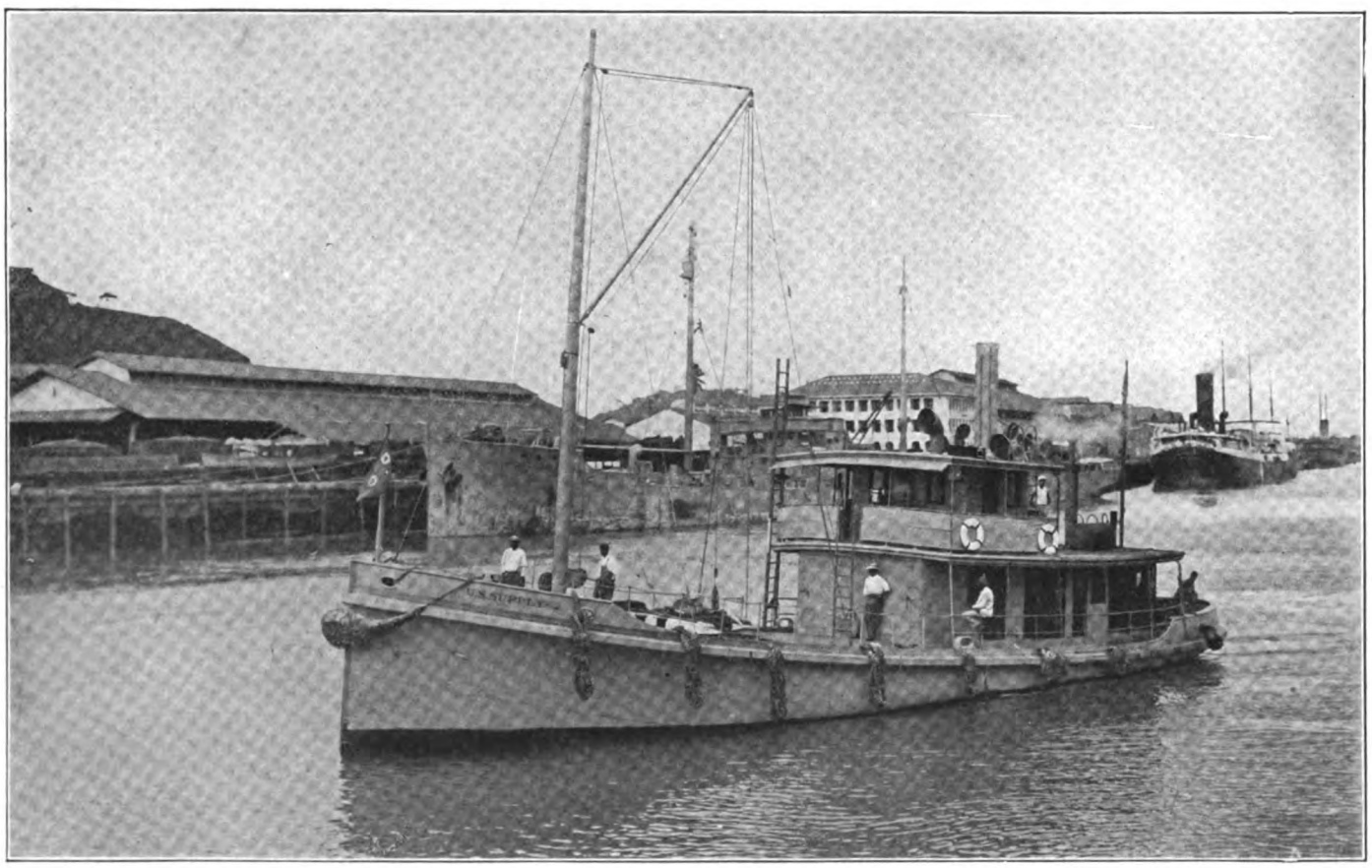
There is a pattern shop with complete equipment of tools such as saws, planers, lathes, etc., and during normal times from thirty to fifty men are employed in this department alone. The pattern storehouse is adjacent to the pattern shop and the large number of patterns are carefully arranged and a card index kept of them so that any particular pattern is readily available.

The iron foundry has a capacity of from 12 to 14 tons daily and is equipped to make castings up to an individual weight of 6 to 8 tons. There is ordinarily a force of from 120 to 140 men on the foundry payroll and many of these men are specialists in this line of work. The importance of having the iron castings for a Diesel engine made in a foundry especially equipped for this class of work, and which devotes its attention entirely to this problem can only be appreciated by those familiar with the requirements of the case. The production of the castings is under the supervision of a metallurgical chemist who exercises close supervision over the grade of iron produced for the various castings.

There is also the steel foundry equipped with an electric furnace with a capacity of one-and-a-half tons per melt, and which turns out all of the steel castings required for the engines. It is well known that steel castings produced by this process are superior to those produced by the converter process and for this reason the electric furnace is used.

The forge shop is equipped with an eight-thousand pounds hammer and several smaller ones and turns out all of the forgings required for the engines, with the exception of the crankshafts. The manufacture of the crankshafts is such a special problem that these are purchased from other concerns who make a specialty of this line of work.

The machine shop is under one roof and includes not only all machine-tools, but also



One of two water-boats built for the U. S. Government; both are equipped with a 120 b.h.p. Nelseco-Diesel engines

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London Ship & Engine Co. can be seen across the river under the X.

the assembling, pipe-fitting, erecting, and testing departments. The castings and forgings enter the shop at the south end and here are located the large machine-tools for handling the bedplate and housing castings. There is a planer with a table 10 feet wide, a 25-foot stroke, with a clear height of 8 feet. There are also four smaller planers of various sizes, including the Niles Bement Pond planer illustrated, with the smallest having a width of 30 inches, a stroke of 12 feet, and a clear height of three feet. For machining the housings there are two Ingersoll milling-machines, which not only mill off the sides, the top and the bottom of the housing but also bore the top for the working cylinders.

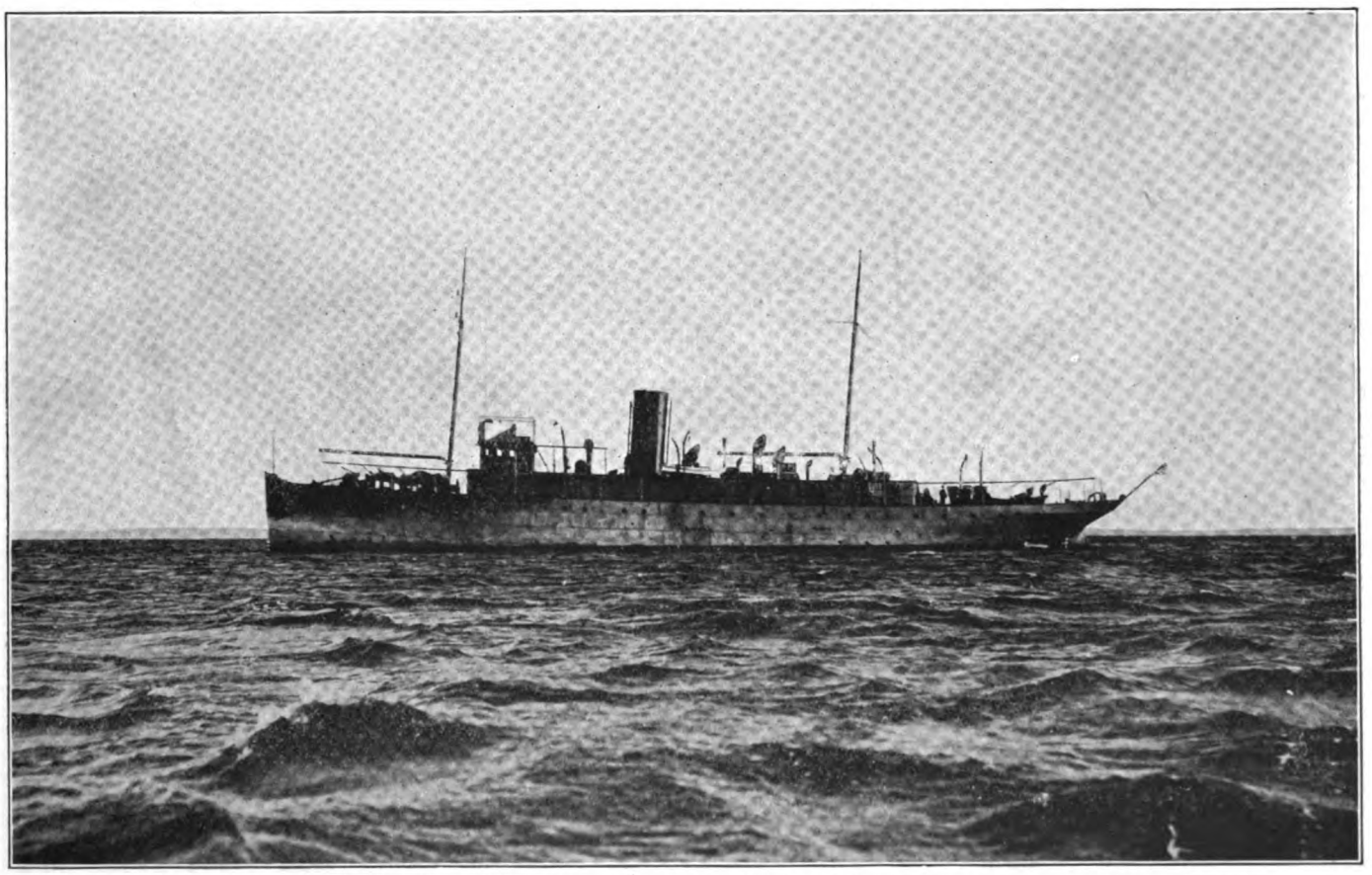
There is a large number of vertical boring-mills, the largest having a table diameter of over eight feet and a stroke of ram of four-and-a-half feet. The boring-mills range in size down to those with three foot diameter tables and stroke of ram a little over two feet. There are also three horizontal boring-mills of various capacities. For the lathes, there is one with a 60-inch swing, three with a 36-inch swing and a very large number of smaller ones. In addition, there are, of course, the proportional number of drilling-machines, milling-machines, turret-lathes, screw-machines, gear-cutting machines, shapers, slotting-machines, cold-saws, grinders, etc. It will be seen from this list given that there is ample equipment for handling all the various castings and parts that go into making up the Diesel engine.

The large castings and forgings are machined entirely by the machine-tools on the lower floor, and the tendency of these parts in the process of being machined is to travel toward the north end of the machine shop, where the erecting and testing is done. The smaller parts are machined entirely in the two galleries, one on either side of the main bay.

There are several cranes for handling the materials. For the main bay, there are the following cranes: one of 10-tons, one of 15-tons, two of 25-tons and one of 50-ton capacity. The 50-ton and the 15-ton cranes are used especially for the erecting and testing departments. In addition to these travelling cranes, there are a large number of jib-cranes so situated as to serve the individual machines to the best advantage. Also for the side bays under the galleries, there are several travelling cranes of from two to five tons capacity. Even on the jib cranes and on these cranes over the side bays, electric hoists are used exclusively.

The care used in insuring the production of only the very best product is well shown by the methods used for machining the individual parts. All pistons, wrist-pins and cams are carefully ground to the required sizes. Very small tolerances are allowed in the manufacture of the various parts and by far the greater number are made strictly to gauges and in jigs, so that interchangeability of all parts is readily obtained, as is always essential in the production of fine machinery.

In one of the galleries at the north end of the shop, is what is known as an assembling department. It is here that all of the small parts are brought and are assembled and carefully tested before being delivered to the erecting floor. Complete valve units are built up; the cams assembled on the cam-shafts; governors and fuel-pumps are assembled and in fact, every unit that can be conveniently handled for assembly is first assembled and tested here. There is a special equipment provided for testing of governors and fuel-



The single-screw motorship "Fulton," driven by a six-cylinder 900 b.h.p. Nelseco-Diesel engine of the two-cycle type

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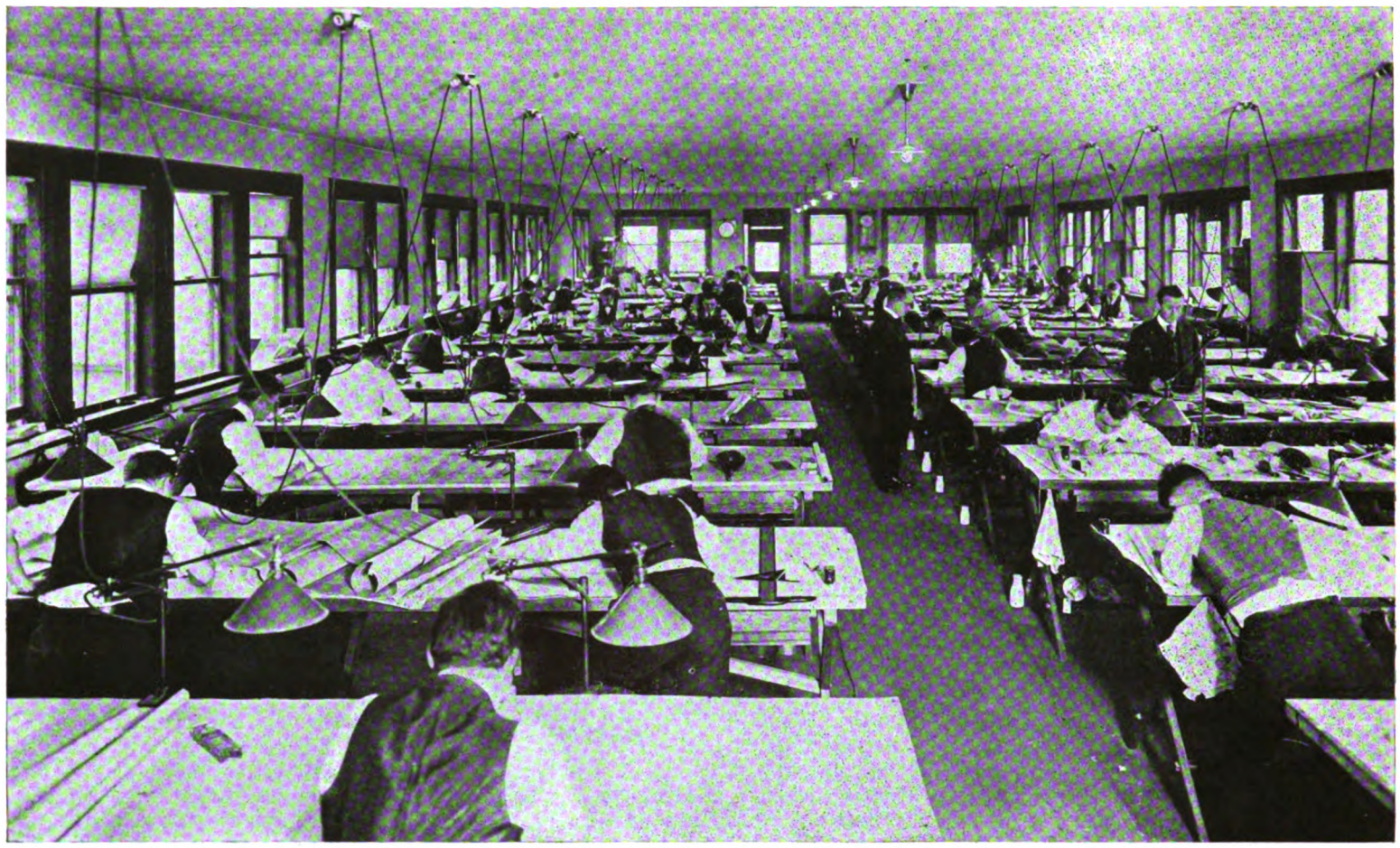


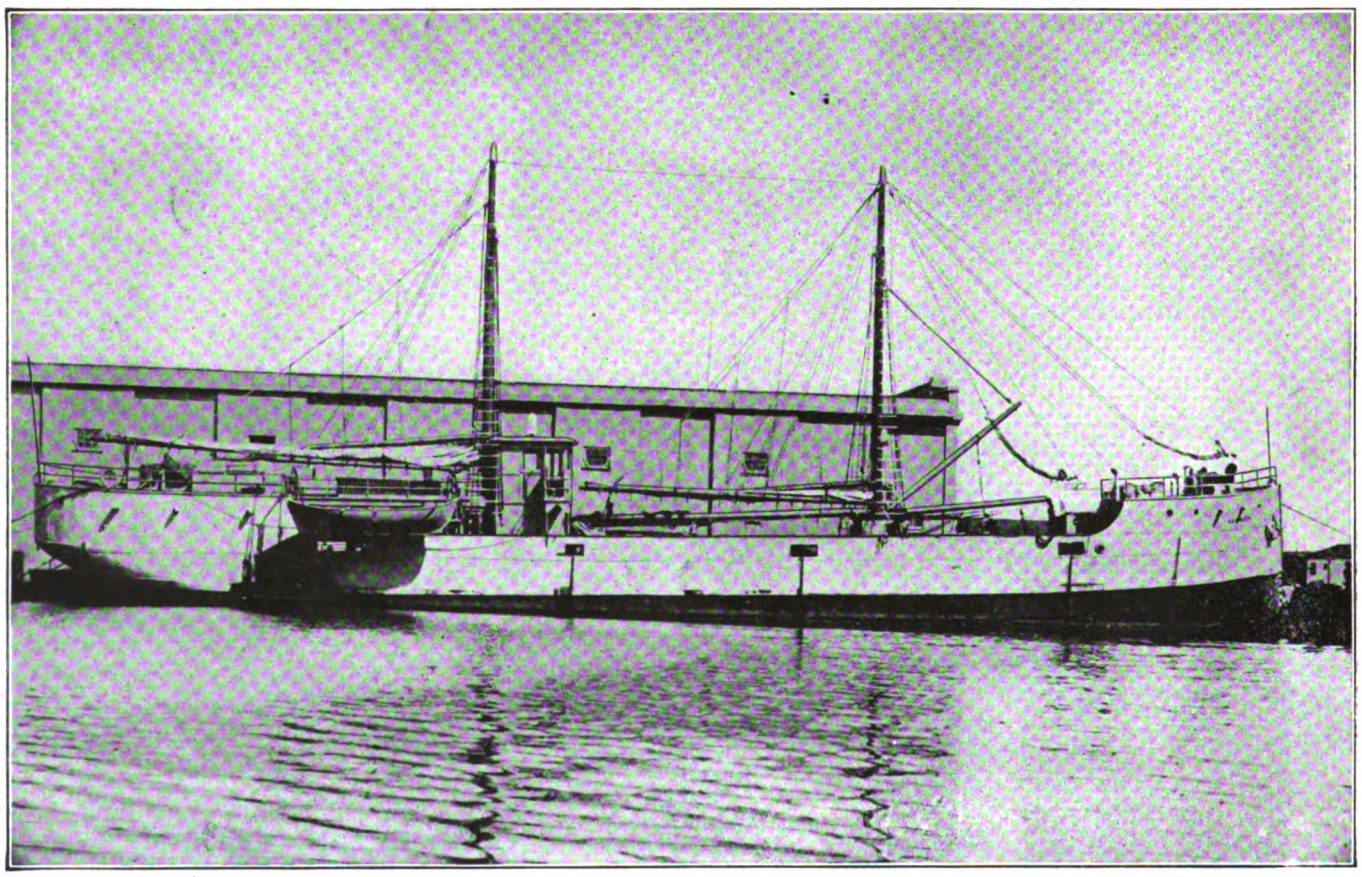
The light and spacious drawing-office at the New London Works

pumps, so that when these units are erected in place on the engine there can be no question as to the proper functioning of these parts.

Adjacent to the erecting floor is the pipe shop, which is completely equipped with all the necessary tools, such as pipe threading-machines, bending-machines, and the equipment for brazing. Copper or brass pipe is used almost exclusively on these engines and the company mentioned that they take a particular pride in the high-grade workmanship in connection with the piping of the engines.

After the engines are erected, they are moved over onto the test-stand, of which there are eight available, and the engine is connected to an electric-generator, which absorbs the load by means of a water rheostat and the engine is run under as nearly the same conditions as will prevail in the boat as possible. The engine's own pumps are used for supplying the circulating-water and lubricating-oil. For instance, there are starting-air flasks available so that the starting, and in the case of reversing engines, the reversing of the engine, can be carried out the same as though the engine were installed in the ship. Each engine is given an endurance run of several hours, after it has been tuned and everything is in proper shape, and during this endurance run the fuel-oil and lubricating-oil consumptions are carefully measured. After undergoing any special tests, the engine is then carefully examined for any defects that may have developed during these trials and is then made ready for shipment.

Shipowners interested in the possibilities of the Diesel-engined motorship will find a day spent at these works a pleasant education.



Cargo motorship "Cerrito," equipped with 240 h.p. Nelseco Diesel engine, 800 tons. Trial speed 8½ knots

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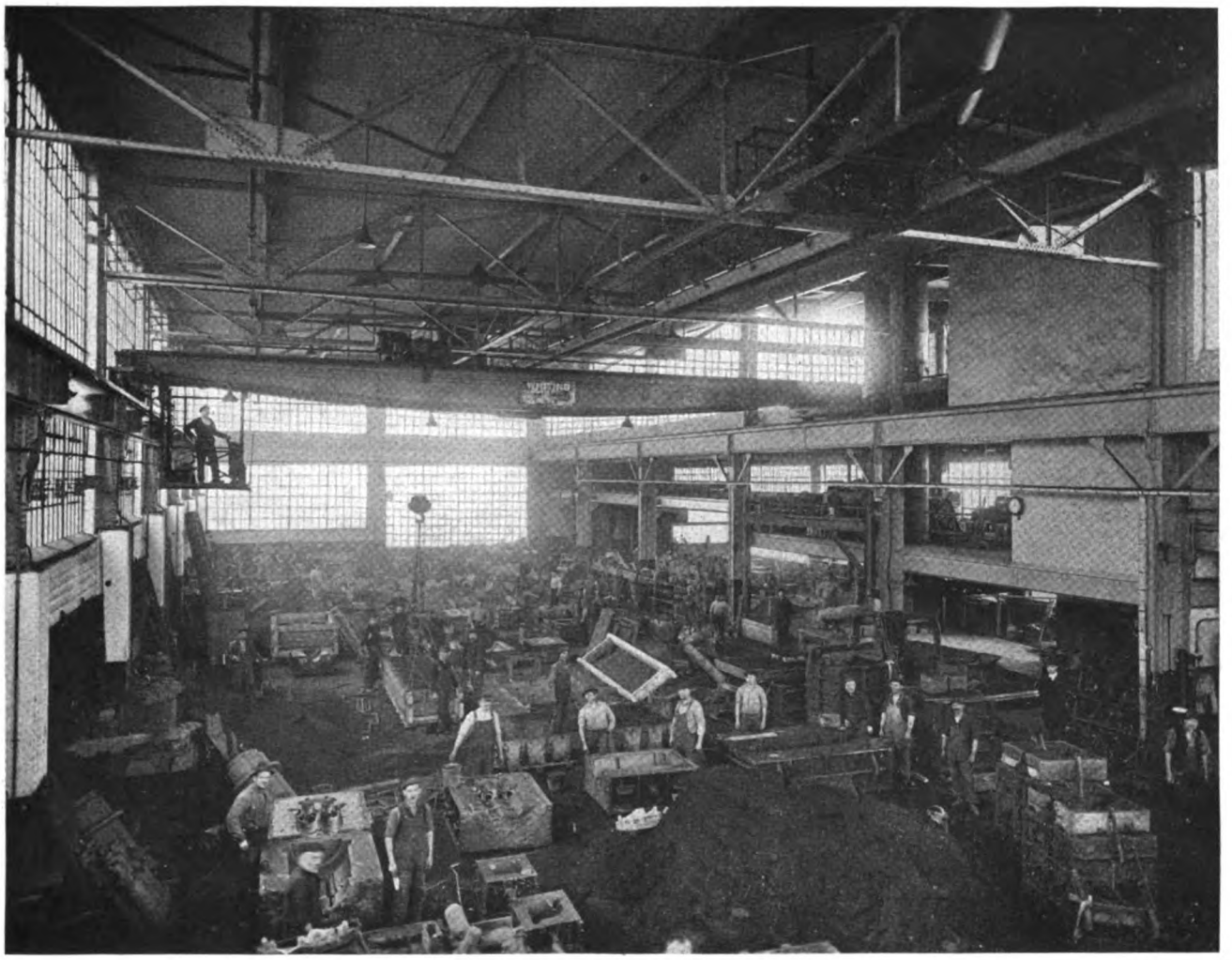
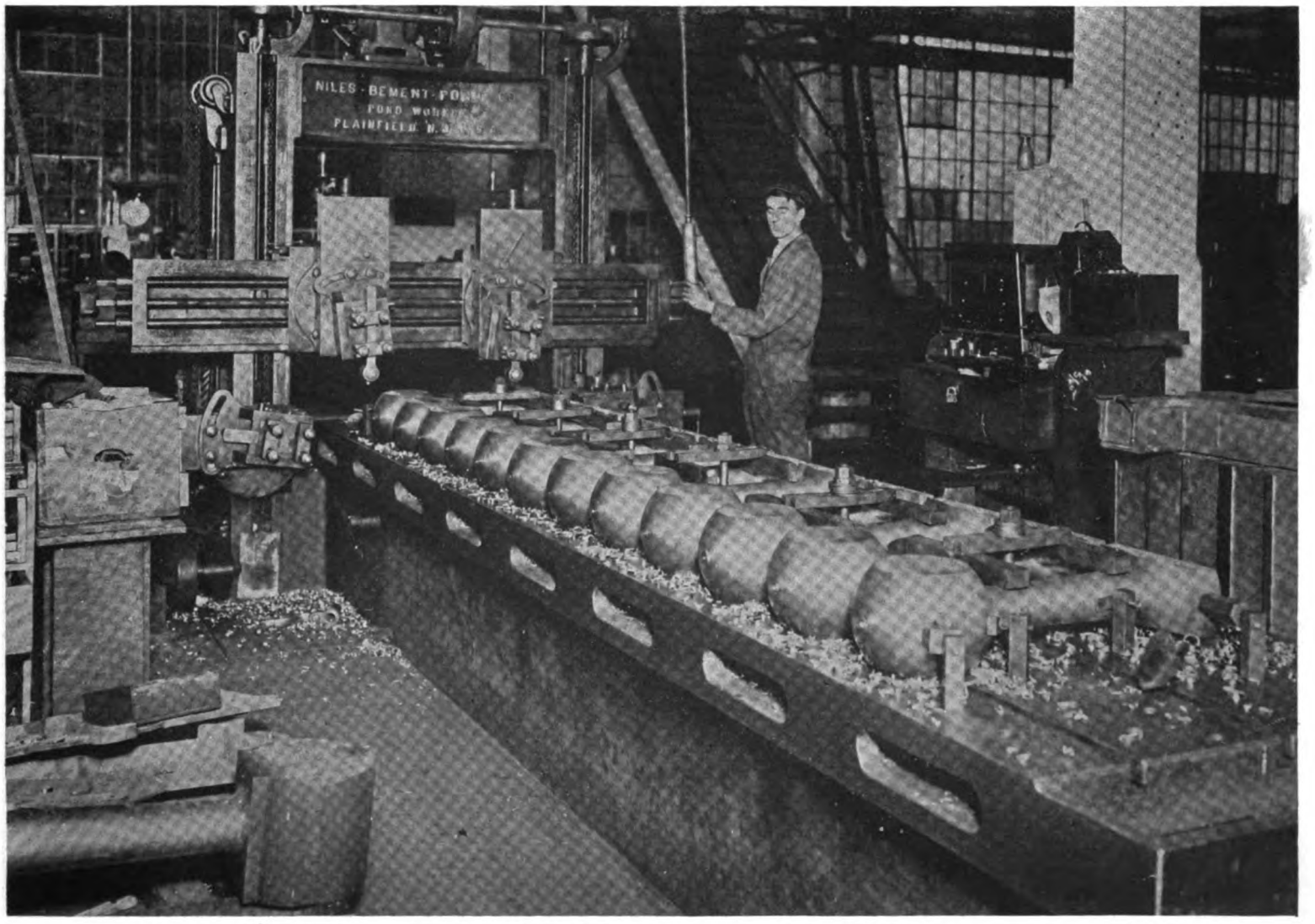


General view of foundry. It has a capacity of about 14 tons



Machining twelve forged-steel connecting-rods on a Niles-Bement-Pond planer. This is another of the excellent machine-tools at the New London Ship & Engine Company's plant

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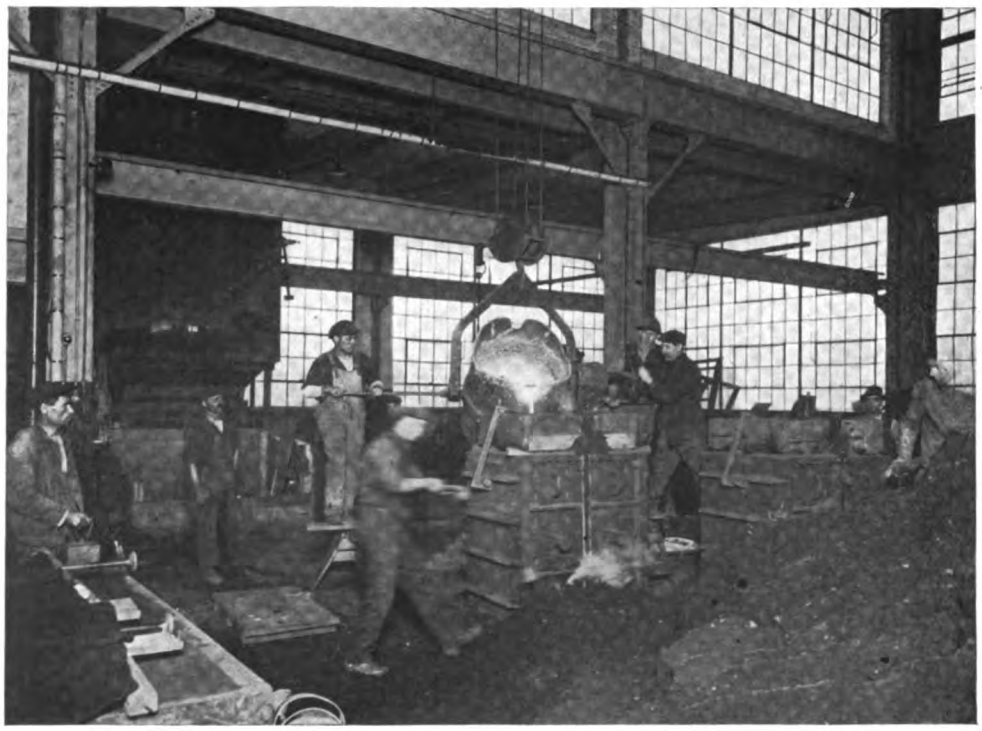


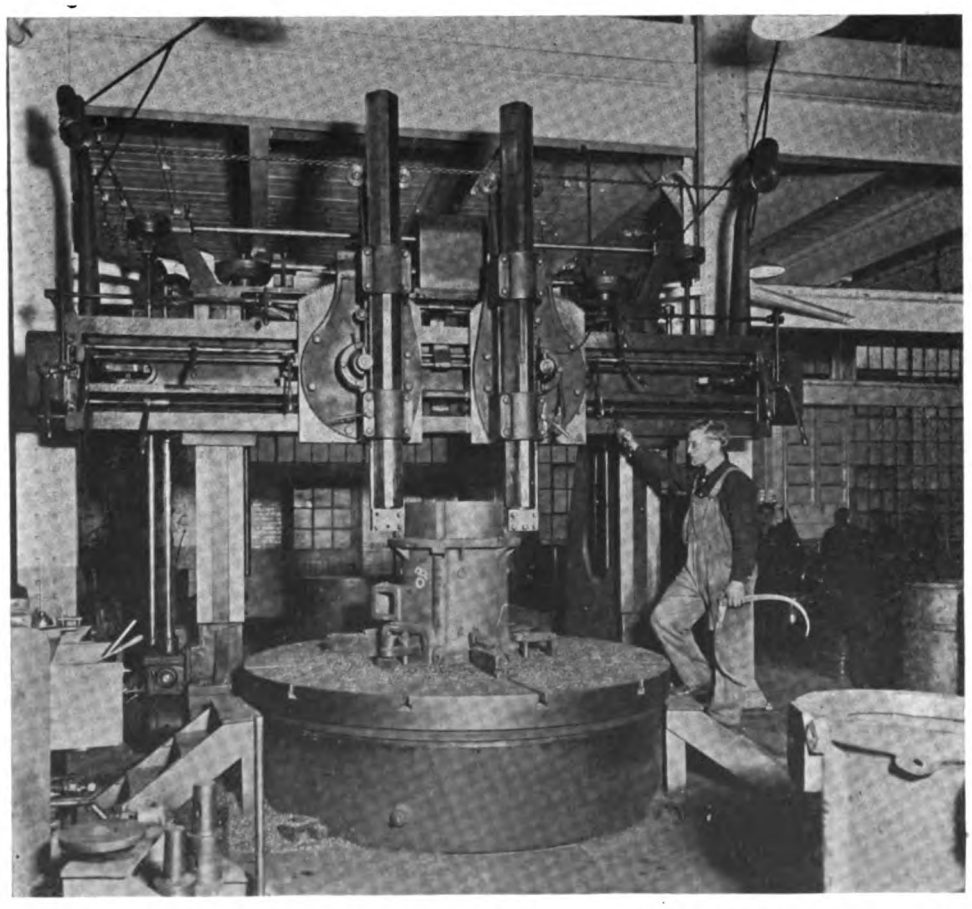
Pouring the molten iron into a cylinder mould

For the valves, the "opposed" system has been adopted, the inlet and exhaust valves being horizontal and opposite each other, while the fuel-injection valve is situated vertically in the cylinder head. One advantage of this design is that the fuel-injection valve is quite a little distance from the piston-top and does not receive so much of the intense flame on one spot as otherwise would be the case.

Just over the crank-pit housing and on either side are arranged the crankshafts, the cams of which operate directly on the rollers of the valve-rockers; but a double action is necessary to actuate the fuel-injection valve because of its situation; hence two rockers are provided, one above the other, the lower working the upper (this may be termed a bell-crank), which in turn lifts the valve spindle. Furthermore, the lower rocker has a special camshaft situated just above the air-inlet-valve camshaft. All of these camshafts are driven from the crankshaft by means of spur-gearing at the forward end of the engine. The air-starting valves are operated pneumatically from the main control-gear and the relief-valves lift automatically in the case of excessive pressure in the cylinder, and are also arranged to be operated pneumatically from the handling gear for venting the cylinders before starting.

Finally, we will give a few details of the design of the Nelseco marine Diesel engines. Special attention has been given to use the weight to good advantage; that is, the bearing surfaces have been designed very conservatively, while stationary parts of the engine, such as bedplate and housing, have been kept comparatively light, consistent with strength and rigidity. The working cylinders are mounted on top of a bronze, or cast-iron, housing, which is cast separately from the bedplate, and the air-compressors are direct-driven from the crankshaft at the forward end. The fuel-pump and the control handles are concentrated at one place for convenience in handling. Crank-pit doors for access to the main crankshaft bearings are made as large as possible; and the cylinder heads are detachable. The crank-pit openings are covered with very light easily removable covers.

Commencing to assemble a large six-cylinder Nelseco marine Diesel engine—Bedding-in the crankshaft



One of the large vertical boring-mills at the New London works. This is a typical example of the excellent machine-tools in this well-equipped plant

Reversing of the engine is obtained by rotating the camshafts relatively to the crankshafts. All the shafts are shifted simultaneously by means of the pneumatic cylinder acting through levers and sleeves. The handling gear is so arranged and interlocked that the engine cannot start either ahead or astern until the camshafts are in the correct position, hence the cams have been properly set for the desired direction of rotation. The handling gear itself is a very simple affair and the engine is controlled and handled by two hand-wheels.

The fuel-pump is driven directly from one of the camshafts and there is a separate plunger for each working-cylinder. The amount of fuel supplied to the cylinders and hence the speed of the engine is controlled by the timing of the suction-valves, which, as mentioned above, is under the control of the handling gear. An emergency governor is fitted to prevent the engine from racing in case the load is suddenly thrown off.

The air-compressor is of the three-stage type, the two second stages or the second and third stage being above and tandem with the first stage cylinders. The pressure carried on the air-compressor and the amount of air compressed is controlled by a throttle on the first stage suction. The air-compressor cylinders are all cast iron and are bolted to a sole plate secured to the end of the housing and supported from the bedplate.

Forced lubrication is used for all the principal bearings. The lubricating oil is generally supplied under pressure from an independent pump to the main bearings. From the main bearings it flows into the crankshaft to the crankpins and up the connecting-rods to the wrist pins.

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Solid-Injection Versus Air-Injection

An Interesting Technical Treatise on a Subject Which Has Important Bearing on Future Design and Construction of High-Compression Marine Oil-Engines for Merchant and Naval Ships

(Second Instalment—Continued from the March Issue)

THE system, therefore, as brought up to date, is as follows: On each cylinder there is a high-pressure fuel-pump which draws its oil supply from the service tank by way of a suction strainer contained in the pump body. The pump which is driven by an eccentric on the cam-shaft, has a suction-valve, mechanically operated by means of a scroll-cam and tappet-rod. Oil is delivered from the pump at a pressure of 4,000 lbs. per sq. inch, and this oil passes to the fuel-injection valve by way of a regulator and a strainer.

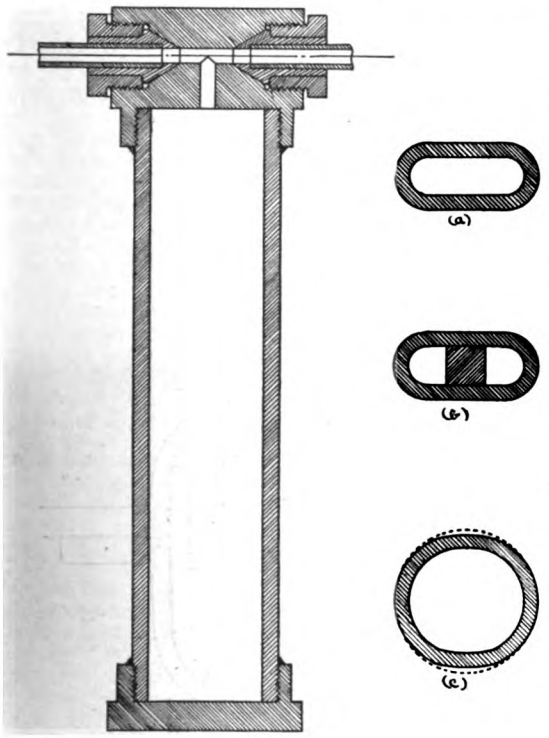

Fig. 5

The regulator or accumulator is formed of a tube of slightly elliptical section, sealed at one end and open to the pressure pipe at the other. The strainer contains a plate having a large number of 1/16 dia holes drilled in but not penetrating the plate, the remaining distance being pierced by holes of 0.017 inch dia. The fuel-injection valve is of the outside spring type, the valve seating being formed on a specially constructed spray nozzle. This nozzle is supplied with a spherical head in which are drilled five holes of 0.019 inch dia. The whole system is liberally provided with cut-out valves and levers. This system is the one most commonly supplied.

Measuring Valve System

This system is illustrated in Fig. 6 and it was fitted on to a larger and slightly different type of engine. The description of the system being as follows: In this design the practice of supplying each cylinder with an independent fuel-pump was abolished, and a common pump set fitted on the end of the engine. This set was driven off the cam-shaft by bevel wheels. The pump supplied two pipes or rails with oil at a pressure of 4,000 lbs. per sq. in. Each of these pipes supplied half of the cylinders by means of a number of small pipes leading from the rail to a valve on the front of the cylinder, this valve was called a measuring-valve. On each of these small supply-pipes there was a box containing an isolating-valve. The measuring-valve took the place of the usual fuel-injection valve, being operated mechanically and allowing high-pressure oil to pass through to the spray-nozzle in the cylinder-head during the fuel-injection period. There was no mechanism in the cylinder-head spray nozzle, the oil passing straight down to the nozzle which was similar in all respects to that used on the previous system. A strainer was fitted between the measuring valve and the nozzle.

Considering the system in detail: The fuel-pump set was comprised of four plungers with separate barrels and valves. These plungers operated in pairs each pair having a common discharge. These two discharges supplied the two fuel rails. Mechanically operated suction-valves were fitted and these could be controlled as engine cut-outs as desired. Forced lubrication was fitted for the pump operating eccentrics and bearings. Each of the fuel rails carried a relief-valve which was set to blow off at 4,000 lbs. per sq. inch. These valves were after the style of the usual mitre-seat valve. The measuring-valve is clearly shown in the illustration.

It was for all practical purposes the fuel-injection valve, situated on the front of the cylinder instead of in the cylinder-head. The valve was placed horizontally and was operated by a lever, mounted on an eccentric-pin. The reason for removing the valve from the cylinder-head was an excellent one in theory for it resulted in the cylinder-head being much simplified by removing an awkward valve-pocket by substituting a much smaller one and as the cylinder-head was a steel casting the saving was appreciable.

The strainer was of the plate type adapted in the previous sytem, and so requires no further description. The sprayer consisted of a steel body, studded to the cylinder-head and provided with a spray-nozzle projecting into the combustion space. It was not necessary to supply a regulator on this system for the fuel rails carrying enough fuel for half the engine and being supplied with relief-valves, prevented any violent fluctuations in the oil pressure.

Praiseworthy as was the attempt to avoid fitting the fuel-injection valve it had disastrous consequences, for it was soon discovered that the system was a failure. It is easily seen from the illustration (Fig. 6) that the practice of mounting this valve on the front of the cylinder necessitated a very long passage between the valve seat and the spray nozzle. To ensure the oil charge entering the cylinder at the correct time, and the correct amount, this length of oil passage had either to be constantly full of oil at injection-pressure or else the incoming charge of oil from the valve had to fill the tube and still retain enough pressure to force itself into the combustion space. In the first case if the tube were constantly full of oil it would keep entering the cylinder which would be both dangerous and wasteful, the second case is not feasible as the amount of oil required per stroke even in large engines is extremely small. Evidently then the system was a failure and was at once abandoned, and the existing type of valve installed. The remainder of the system subject to the following modifications was retained.

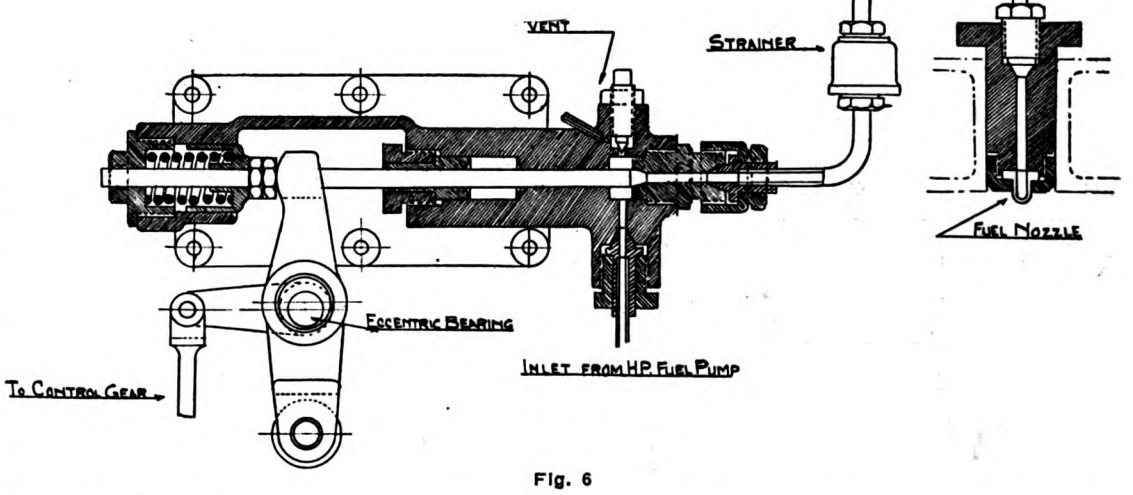

Fig. 6

The relief-valve on the fuel rail was found to be unsatisfactory in operation having to hold pressures up to 4,000 lbs. The spring was heavy, but even then it was useless when it came to closing the valve immediately any excess pressure was relieved, so that when the pressure once exceeded its limit a series of fluctuations was occasioned. Various anti-chattering devices were adapted, but with no appreciable success.

At last it was decided to abandon the mitre seat, and to adapt a flat-seated valve, the spring being of exceptionally heavy section. This valve is illustrated in Fig. 7. The valve as will be seen is floating a ball-pointed spindle carrying the spring load holding the valve on its seat. The spring could be adjusted by the arrangement shown, the adjusting-gear being locked by a handwheel. The spring being of such a heavy section, the valve left was limited to 2/1000-3/1000 of an inch, and immediately the pressure fell to normal the valve closed, and kept closed until another rise in pressure occurred.

The first valve of this type fitted was made of gunmetal, but the face of the valve soon became badly scarred, and a hardened steel valve was substituted. The fuel-pump eccentrics gave a little trouble, for they very frequently ran hot, although fitted with forced lubrication. This was easily overcome by lining the pressure half of the strap with an anti-friction metal when the trouble disappeared. A new type of strainer was adapted also. This was not in any way due to any faults in the plate-type, but was an endeavor to remove the drilling of such fine holes as the plate-type demanded.

The new type is illustrated in Fig. 4c. It consists of a number of small discs having a raised rim on one side. These discs are mounted together so that the raised rim on one disc bears on the flat side of the next disc. As the raised rim on each disc has a large number of small V grooves milled radially in it, it will be seen that an infinite number of minute passages are provided. Oil enters on the outside of the discs, passes through the grooves and rises to the outlet by way of holes drilled in the centre portion of the discs. The discs are held in place by a small stud. This type of strainer was exceedingly efficient in service.

This system as brought up to date by these modifications is not, correctly speaking, "a measuring-valve system," but the title serves for the purposes of this article to distinguish it from the remainder. The final system, therefore, is as follows: A high-pressure fuel-pump having four plungers is mounted on the end of the engine. This pump draws its supply from the service tank by way of mechanically operated suction-valves. The plungers are operated by eccentrics, the pressure halves of the straps being lined with anti-friction metal, while both bearings and eccentrics are supplied with forced lubrication.

Two separate fuel rails are fed by the pump, the fuel-pressure being 4,000 lbs. per sq. inch. These fuel rails are each supplied with an adjustable flat-seated relief-valve. Each rail supplies half the engine and is supplied with a small pipe for each cylinder which it feeds. An isolating-valve being provided on the rail for each of these pipes. The oil is led by this small pipe to the fuel-injection valve passing through a strainer of the grooved-disc type on the way. The fuel-injection valve is of the type previously described.

This system however has not been adapted to any great extent.

The Balanced Valve System

This is the latest, and most certainly the best system, it is illustrated roughly in Fig. 8. It possesses a certain similarity to the final arrangement of the "measuring valve system." A description of it being as follows:

The high-pressure fuel-oil pumps are situated at the end of the engine, the pump driving-shaft being driven off the crank-shaft by skew wheels. The fuel-pump is divided into two sections each

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section having two plungers. The suction is drawn from the ready use tank and each section delivers into a fuel rail running along the front of the engine, while each rail feeds one-half of the engine. On each rail is mounted a block containing a relief and a regulating valve. A block containing an isolating-valve and a fuel-strainer is mounted on the rails, opposite each cylinder. The small pipes from these blocks going direct to the fuel-valves in the cylinder-head, these fuel-valves being of the balanced-pressure type.

In detail the system is as follows: The fuel-pump consists of two blocks mounted on a common bracket. Each block contains two plungers delivering into a common discharge pipe; but, drawing their supply through independent suction valves, these-suction-valves being mechanically operated. The pump-shaft bearings and the eccentric-straps are fitted with forced lubrication. The delivery from each block is kept independent, the one from the other. The block containing the relief and regulating valves has two separate valves in it. These valves were the same type as that shown in Fig. 7, the regulating was set to blow off at 4,000 lbs. per sq. inch, but could be adjusted as desired. The relief-valve was set to 5,000 lbs. per sq. inch, but was locked in this

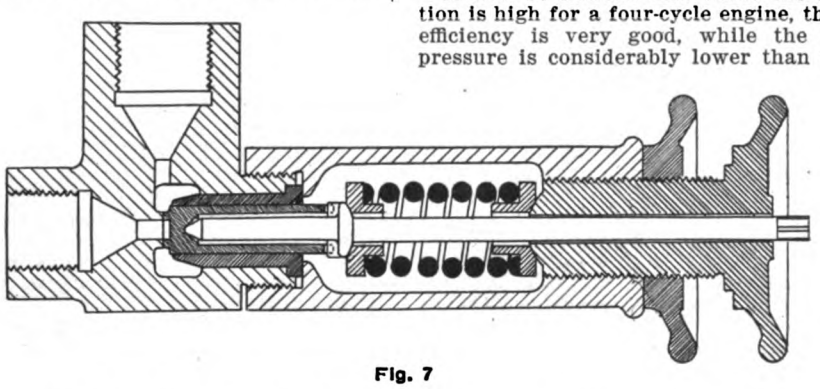

Fig. 7

position by fitting a washer between the adjusting handwheel and the locking handwheel, or rather it was hardly locked but the relief pressure could not be increased without removing the washer, an impossible feat while the engine was running. The reason for fitting the relief-valve was that in the event of any sudden heavy rise in pressure, with which the regulating-valve could not efficiently cope, the relief-valve would prevent any dangerous pressure being reached.

The fuel-valve was of an altogether different type to those adapted on the two foregoing sys-

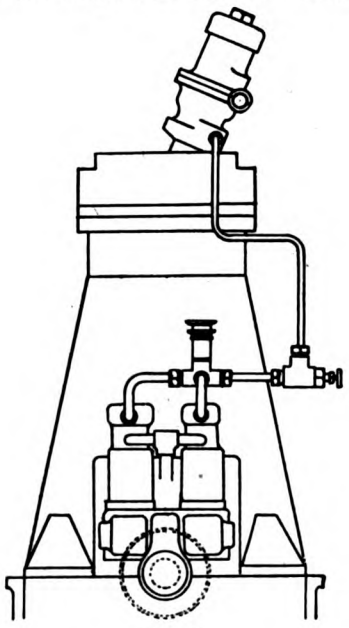

Fig. 8

tems. It is a well-known fact that in the ordinary fuel-valve having gland packing round the spindle, there is a decided tendency for the valve to "stick" open, in any case, a large amount of unnecessary work has to be done in overcoming the gland friction. This can be avoided to a great extent by using a balanced-pressure valve, where a rotating spindle works through a gland in place of the valve-spindle, thus reducing the friction and the tendency for the valve to "stick." The type used in this system is illustrated in Fig. 9.

It will be seen the valve-spindle, its operating lever and spindle are inside the valve body being totally enclosed in an oil-tight space. As will be seen in the horizontal section, the operating spindle is extended through a gland to the outside of the valve. A lever being connected to the exposed end. Oil is admitted to the interior of the valve-body, the whole of the interior being full of oil at injection pressure. As the valve is securely seated, there is an excess of oil pressure tending to keep it on its seat. Also when the valve is opened, the end pressures on the valve are balanced. For these two reasons the valve spring can be made much lighter than in other valves. A vent is provided in the top of the valve. The valve nozzle is the same as in the previous systems.

No modifications were required on this system, the engine working perfectly with the designed system. Progress with this system was retarded by the war however.

Results Obtained on Test

The following figures will be of interest before making any comparison between, the solid-injection system and the air injection system. During a fairly recent trial on an engine fitted with the first system in its up-to-date form the following results were obtained:

Fuel-Consumption per B.H.P. hour.....0.463 lb.
Fuel-Injection Pressure per sq. inch.....3000 lbs.
Mechanical-Efficiency 89%

It will be noticed that while the fuel-consumption is high for a four-cycle engine, the mechanical efficiency is very good, while the fuel-injection pressure is considerably lower than the designed, giving some indication of the latitude allowed in the injection pressure. A typical indicator-card of an engine fitted with this system is shown in Fig. 10.

For the second system, I have unfortunately no record whatever, while for the third system the only figure I possess is a fuel-consumption which was given as 0.443 lb. per B.H.P. hour, this figure however I would give with reservation.

Comparison Between Solid and Air Injection

For the purposes of comparison, the air-injection system will be considered as the standard system, and the relative merits and demerits of the solid-injection system stated with respect to this standard system. There is no intention in this article, as already mentioned, to claim any superiority for either solid or air-injection, but rather to give a fair comparison, and to leave a final decision to the reader.

There are three outstanding points in which the solid-injection compares unfavorably with the air-injection system, viz:

(1) High fuel-consumption.
(2) Lower Thermal-Efficiency.
(3) Higher Working-Pressures.

High Fuel Consumption

This is by far the most serious disadvantage it possesses, of where there is a high fuel-consumption, there is of necessity a high cost of operation, and every likelihood of a smoky exhaust. All the solid-injection systems described were fitted on four-cycle engines, to obtain a comparative figure. I took at random from the pages of the "Motorship," the following fuel-consumption of a four-cycle engine: 0.41 lb. per B.H.P. hour. This is not any specially selected figure, and when we take that the fuel-consumption on a solid-injection engine is anything from 0.44 to 0.46 lb., the difference is at once apparent, the increase in fuel-consumption being 7 to 12%.

In a vessel of large power, taking long voyages this advantage of the solid-injection engine would be very great indeed. The exhaust-gases also are a point to be reckoned with, more especially during the war just over, but the difference between an air-injection engine and a solid-injection engine is not vital in this respect, for there are smoky air-injections and clean solid-injection engines and vice versa. However, the advantage, so far as this is concerned, lies with the air-injection engine undoubtedly.

Thermal-Efficiency

This point is also an outcome of the high fuel-consumption, for poor combustion, due, of course, in this case, to less efficient atomization, means that a certain amount of the charge is not burned and passes out with the exhaust-gases. This results in the low thermal-efficiency, which cannot be avoided until more efficient atomization is obtained.

High Working-Pressures

High fluid-pressures are always best to be avoided for although they can be made and kept tight on test, they have a disconcerting habit of giving out when in regular operation, and when once a joint does, a stoppage is often necessary before it can be put right. A point to be watched

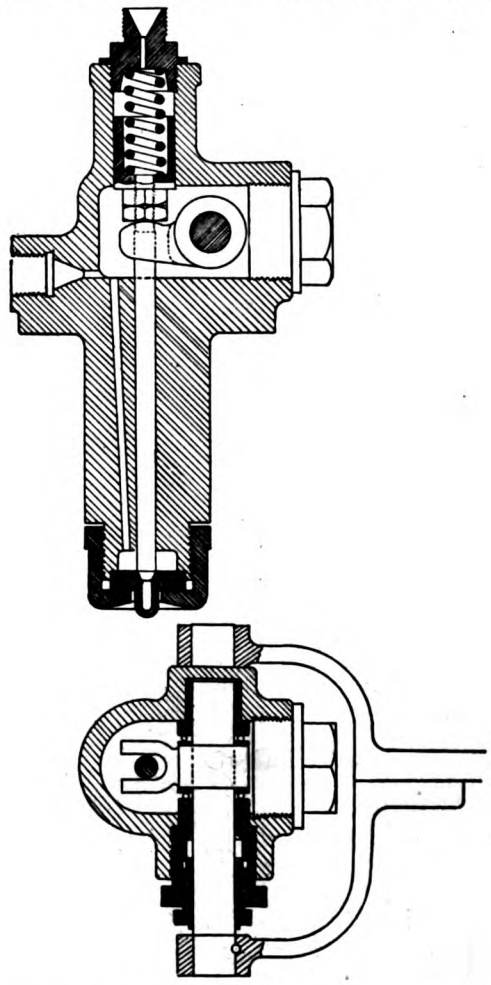

Fig 9

therefore in the design of a solid-injection system is the elimination as far as possible of all pipe joints.

These are the three principal points in which the solid-injection engine is at a disadvantage in relation to the air-injection engine. Now to consider the other side of the case and to see what advantage it passes over air-injection, for it must possess some or else it would have been discarded long ago. The three chief arguments in its favor ars:

(1) Simplicity.
(2) Saving in space or power.
(3) Higher Mechanical-Efficiency.

CYL. No 3

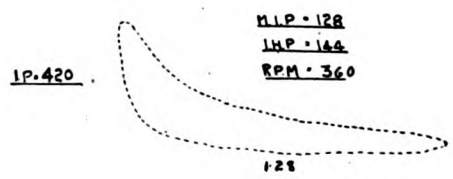

Fig 10

Simplicity

In an air-injection engine, there is the compressor, with its controls, its coolers, pipes, and separators, the air-pipes from the compressor to the storage reservoir, the pipes from the reservoir to the fuel valve, the fuel-pipes from the pump to the valves, and the interior mechanism of the valve all tending to complicate the engine, and giving more scope for careless handling. It is obvious therefore than in a solid-injection engine where out of all this list there is only the fuel system remaining, that a much simpler engine has been obtained. The attendant has only his fuel and lubrication systems to consider when running without the extra labor of a compressor. True, a compressor must be fitted for providing starting-air, but this is usually an auxiliary set, and only operated as required to replenish the storage reservoirs.

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Saving in Space and Power

The injection-air compressor requires as a general rule from ten to twelve per cent of the engine power to operate it. Now consider an engine developing 1,000 B.H.P., then 100-120 B.H.P. have been used in driving a compressor, and the fuel-injection pumps a matter from 1 to 1½ H.P. Now in a solid-injection engine, removing the compressor, the power required to operate it can be added to the engine power, for the fuel-pumps only require from 2 to 4 H.P., the increase is therefore negligible. In this hypothetical case, therefore, we have increased the power transmitted to the propeller approximately ten per cent, and yet the engine will be less in length than before. Consequently, even if the figures vary slightly from those given above, a combined saving in space, power and simplicity is obtained; but, it must be remembered that this saving in power, refers only to the possibility of obtaining more power in the same space, and not in fuel-consumption, which is always higher per unit of power than in air-injection engines. [The larger fuel-bunkers will encroach upon the cargo space and reduce the earning power of the ship.—Editor.]

Mechanical-Efficiency

The saving in mechanical-efficiency in a solid-injection engine is also an outcome of the saving of the power necessary to operate the compressor; for, obviously if 10-12% of the engine power was necessary to drive the compressor, this power will now go into the Brake-Horse-Power developed by the engine, and as the mechanical-efficiency is the ratio existing being the Indicating-Horse-Power and the Brake-Horse-Power, the efficiency is naturally higher.

Thus the respective merits and demerits of the system are presented and it is not intended to attempt to formulate any decision as to which system is the most advantageous, it being better for the reader to draw his own conclusions from the facts set before him in this paper. One point, however, should be emphasized and that is, that any further progress must necessarily be in an attempt to secure better pulverization and a consequent saving in fuel-consumption.

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed.)

DEAD-WEIGHT CAPACITY ON CARGO-CAPACITY TONNAGE

To the Editor of "Motorship."
Sir:

I have read carefully the February issue of "Motorship" and paid particular attention to several items.

Mr. Hurley's comparison as to the relative efficiency in the final sense of the word, which means as far as a vessel is concerned, what it costs per ton to carry its freight, shows up very strongly in favor of the motorship.

It is impossible, however, unless you have details of both the vessels and know the peculiar conditions under which each worked and the difficulties they may have encountered, to make any close comparison.

I am a firm believer in the motorship. The best proof of this is the fact that our company, I believe, ordered the first two motorships to be built under the American flag—the "Mt. Hood" and "Mt. Shasta." These vessels, like all pioneer types, have given us some trouble, but we feel that the minor difficulties encountered in the first few months of their operation have been eradicated and that they will prove to be economical, money-earning vessels.

Your article about discarding the "dead-weight-capacity" term I am afraid is hardly possible of fulfillment at the present moment. As long as so many coal-burning vessels are in service it will be necessary to speak of the dead-weight capacity so that a charterer or owner may arrive at the cargo carrying capacity after he has decided upon his bunker requirements. If all vessels were oil-burners exclusively, the change might be made at once.

Very truly yours,
J. B. AUSTIN, JR.,
Vice-President & General Manager.

The Globe Line,
Gaston, Williams & Wigmore S. S. Corp.,
39 Broadway, New York, N. Y.

TEMPERATURE OF PISTON-COOLING WATER

To the Editor of "Motorship."
Sir:

I wish to refer to Mr. R. P. Mason's letter in "Our Reader's Opinions," January, 1919, concerning the cooling of pistons. I am a marine-engineer and have been to sea with Danish motorships for some years. My experience includes both oil and water-cooled pistons, and I think it is pretty hard to decide which system is the best, neither will give much trouble as long as the engines are operated carefully.

When Mr. R. P. Mason is speaking about the discharge waters being 45 degrees centigrade difference between the intake and discharge water, he is mistaken.

In these Danish motorships we used as far as possible to keep a temperature of about 45 degrees centigrade in the discharge-water, as experience has shown this temperature to be the best for the combustion and for the duration of the engines. This is under normal conditions and full speed, when going slow or sailing in water of a temperature near 0 degree it might be hard to keep the discharge temperature that high, it might be necessary to decrease as much as to 35 degrees or even 30 degrees. And when the temperature of the sea-water increases to 30 degrees the temperature of the discharge water will increase to 50 degrees or 55 degrees. Where the oil-cooling is used the discharge temperature will change according to the temperature of the sea-water and be from 40 to 70 degrees as the oil already is heated a little when passing through the shaft and rods. All degrees mentioned here are centigrade.

Yours very truly,
ESKILD JENSEN.

1378 McAllister St.,
San Francisco, Cal.

NORWEGIAN MOTORSHIPS WITH WERKSPOOR DIESEL ENGINES

To the Editor of "Motorship."
Sir:

We desire to draw your attention to the fact that the list of Werkspoor-Diesel engines being fitted in motorships now under construction for Norwegian owners as published in your issue of December 1918, page 29 is not quite correct.

Herewith follows a list of motorships we are building for Norway:

Name of Ship	Owner (abbr.)	Number of Motors Per Ship	I.H.P. of Complete Plant	Number of Cylinders Per Motor
"Salerno"	Thoresen, Kristiania	2	2900	6
"Athene"	Salvesen, Kragero	2	2900	6
"San Miguel"	Thoresen, Kristiania	1	1500	6
"San Paulo"	Thoresen, Kristiania	2	2900	6
— ? —	Norske, Handelsselskap	1	450	4
"Sardinia"	Thoresen, Kristiania	1	2000	6
"Geisha"	Winge, Kristiania	2	2900	6
"Tosca"	Winge, Kristiania	2	2900	6
"San Andres"	Thoresen, Kristiania	1	2000	6
— ? —	— ? —	1	500	4

Trusting you will make this revision,
Yours very truly,
WERKSPOOR,
Per C. Kloos.

Amsterdam, Holland.

[The list in question came from Norway, but we are glad to give publicity to your letter.—Editor.]

INFORMATION DESIRED

To the Editor of "Motorship."
Sir:

I am very much interested in the heavy-oil engine. I am foreman of the Machine department of I. L. Snow & Co. of Rockland, Me., and my duties bring me in contact with steam, gasoline and heavy-oil engines. This firm caters especially to marine work, and being desirous of a better knowledge of the heavy-oil engine, I will be pleased to have you recommend to me the best treatise on this subject for one who is not a college graduate. What I desire is good, practical information, without too much of the higher mathematics involved.

Have you a bureau of information on oil-engines? The reason I ask is because questions are constantly coming up pertaining to oil-engines and I know of no better authority than the editor of "Motorship." Would you kindly answer the following questions. For instance:

(a) How does the steam-engine and the oil-engine compare in weight per H.P.?

(b) What advantage has the two-cycle engine over the four-cycle engine?

(c) In your opinion, which cycle do you think will be used for engines in the big ships?

(d) Is the spray-air system used on the semi-Diesel engine? Is it always used on the full-Diesel engines? And why? Why not solid-injection of fuel-oil with full-Diesel engines?

(e) Do you think the double-acting oil-engine, both full and semi-Diesel, two and four cycle, will be used in the larger H.P.? For instance, ocean liners? This style of engine, it seems to me, would eliminate escaping gases and would produce a greater H.P. per pound weight of engines?

(f) A little over a year ago, we installed in the motorship "Edith Nute," two 240 H.P. full-Diesel, four-cycle, 8-cylinder Nelseco (New London Ship & Engine Co.) engines. This experience has aroused our interest in the heavy-oil engines.

(g) Fuel-oil being so expensive at the present time, do not motorships use some substitutes? For instance, kerosene? Would this fuel be practical in the larger engines? It is used on this coast in the small fuel-oil engines.

(h) What would you recommend for power in a 150 ft. beam trawler? Would you recommend full or semi-Diesel engines? Twin or single screw? What auxiliaries would be necessary?

(i) There is some talk in our concern of building such a ship. What part of ship would you recommend locating fuel tanks? Would you recommend dry or wet exhaust.

(j) Which cycle of heavy-oil engine is the most practical on the whole?

(k) What arrangement of piping is made as a rule on motor craft to deliver fuel-oil to tanks?

(l) Would a manifold attached to the side of the engine-room in some convenient place with a valve for each tank, said manifold being piped to a convenient place on side of deckhouse, so that hose connection may be had from tank cars or oil lighter, be practical.

(m) What size connection would you recommend for this?

Having made the trip to Norfolk in motorship "Edith Nute" and helped with taking on fuel-oil, I observed a sad mistake made by using 2½ inch filling pipes. This was brought forcibly home to us all when the skipper of the oil barge handed us a 6 inch hose. Our only recourse was to remove the manhole plates and fill through the manholes.

Yours very truly,
MAURICE R. SNOW.

Rockland, Maine.

[We are glad at all times to answer questions of general interest in these columns. Among Diesel-engine books are Diesel Engines," by A. P. Chalkley, published by Constable and Co., London, England; Diesel Engine, by A. H. Goldingham, published by Spon & Chamberlain, New York; and Diesel Engine, by G. Suppino, published by Lippincott & Co., Philadelphia, Pa., but they are fairly technical. Your other questions we will answer in order.

(a) The heavy-oil engine is heavier than the average marine steam-engine; but is considerably lighter than steam-engine and boiler together, to say nothing of the water in the boilers, and the condensers, evaporators etc.

(b) This is a question over which engineers have different theories, and has been discussed many times in our columns. An interesting article on the subject appeared in our February issue.

(c) The same remarks as (b) apply.

(d) A valuable article on this subject commenced in our March, 1919 issue, and is continued in this issue.

(e) The same remarks apply as given in our answer (b).

(g) Kerosene would make an excellent fuel but is more costly than fuel-oil or crude-oil.

(h) Either surface-ignition or Diesel engines would be suitable if of a reliable make. See the article on the motor trawler "Pioneer" in our issue of October, 1918 for details of auxiliaries.

(i) Dry exhaust, with water-cooled exhaust-pipes and water-cooled muffler. Wet exhaust will cause damage if there is any

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sulphur in the oil. If a steel vessel, locate the fuel-tanks under the engine-room flooring, with supply tank in the engine-room.

(j) See answer (b).

(k) This depends upon the arrangement and position of the fuel tanks, and the size of ship. Also consult the Standard Oil Co. of N. J.

(l) Answer to (k) also applies to this question, and the same to answer (m).—Editor.]

SHIP'S ENGINEERS FIND "MOTORSHIP" USEFUL

To the Editor of "Motorship."
Sir:

Enclosed please find money-order in payment of a year's subscription to "Motorship" beginning with the March number.

I have the February number and it is the best magazine of its kind I have ever seen. I am a marine-motor engineer so it is right in my line.

Your very truly,
EDWIN B. ARNOLD.

P. O. Box 8, Warren, R. I.

DEPOSITS FROM COOLING WATER

To the Editor of "Motorship."
Sir:—

I am a reader of "Motorship' and would like to offer a suggestion to engineers of motorships, as I have had experience in overhauling several types of engines for a local repair plant. I find that the water-cooling space is generally coated with salt, about 1/36" to 1/16" thick due to evaporation of cooling-water while throttling engines or neglect to fit up an auxiliary water service independent of pumps on the engines, or to cut it short, over-heating of cylinders. Now this is bound to occur in all types of engines once in a while, and when once hot water that remains in jackets evaporates depositing salt, this could be remedied by giving water jackets a good boiling out with common soda, shutting off all drains and connecting up to small steam line, letting solution soak over night and flushing out with fresh water in morning. This should be done about once a year.

I also notice that engine-builders neglect to supply ships with a set of wear-down gauges for main bearings which lets the engineers know just how much the shaft is down.

Yours very truly,
THOS. F. HAGAN.

71 Pearl Street, New York City.

ENGINE ROOM TELEGRAPHS

To the Editor of "Motorship."
Sir:

We beg to call your attention to page 16 of the Jan. number of Motorship, and to your reference to Cory type engine-telegraph equipment, in the concluding paragraphs of your very fine article re the M.S. "Bullaren."

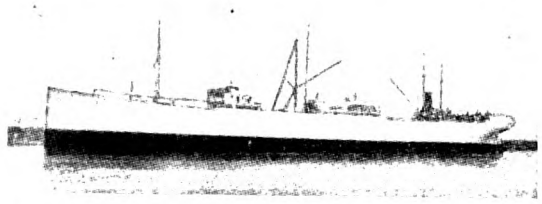
Of course, the Cory & Son equipment is very well known, while the type manufactured by ourselves has only recently been placed on the market, nevertheless we hope the following information will enable you to regard us as a strong factor in the field, and one which has the advantage of superior features and construction when compared to any type of mechanical engine-telegraph produced by other manufacturers to date.

Our full-size demonstration installation of ball-bearing, safety-type instruments has met with the unqualified approval of a daily increasing number of naval architects, engineers, masters and builders. All are quick to recognize the distinct advantages we have incorporated, and we are already assured of considerable local business as a result. Also, we are unable to find an ad. of Cory equipment which covers more than ½ page in any of the marine journals, and none in Motorship. While Cory relies on his reputation for future orders, we intend to build up by advertising, and the volume of sales at the end of a suitable period will show the inevitable results.

As to the feature of accuracy, which is only obtained in the old standard types of telegraph by constant readjustment of the connections, we refer you to the photo of engine room of the "Bullaren," on page 14. You will notice that the pointer which controls this pair of motors, is considerably "off center" of the position intended, which is "Stop." You will find this condition on quite a large number of vessels.

We have made the automatic centering of these instruments an absolute certainty. This is only one of a number of improvements which are exclusive in our equipment, which operates accurately with two connections, while the old types require four between bridge and engine-room, and in twin-screw vessels we use four as compared to eight required with other types.

While all the older manufacturers of the mechanical engine-signal instruments have been gradually reducing production-cost in order to meet competition, we have begun by making quality and excellence our first consideration, and merit will win here if anywhere, for there can be no poorer economy than to put a cheap telegraph on an otherwise costly ship, risking damage to



The new Danish-built Diesel-driven motorship "Bonheur," sunk by a mine on Christmas Day

docks and vessel thru failure of signal gear during the entire life of the ship.

With your help we will put this superior equipment before those who are using modern engines and equipment on board ship, and we hope to be able to credit a large volume of sales to "Motorship."

The writer remembers your Mr. Palmer from his unexpected visit to the U. S. S. "Cheyenne" in the Straits, in the summer of 1910. I was a member of the Navy crew which made the trip from 'Frisco, and remained on board in charge of the engineer dept. of the ship, until Feb., 1913.

Yours very truly,
INTERNAL-COMBUSTION STEAM ENG. CO.
By Paul C. Mulligan,
Seattle, Wash.

[The Swedish motorship "Bullaren" was equipped with engine-room telegraphs made by a British firm and we merely drew Messrs. Cory's attention to the fact that by not advertising in "Motorship" they were missing many good business connections and your remarks regarding Messrs. Cory's not advertising extensively endorses the editorial remarks made on page 16 of our January issue. We did not include your name in our reference because the remarks did not fit your case as your advertisement is in our columns, and doubtless you will benefit to the extent of receiving business connections that others may miss.—Editor.]

MOTORSHIPS ON THE GREAT LAKES

To the Editor of "Motorship."
Sir:

Just a few lines to say that I am very pleased with "Motorship" and read every issue from cover to cover. I think there are great possibilities for the Diesel-engined ship. Take our own Canadian Lake Trade. There have been built Diesel ships for this route, but two of them have had their

A 52 in. by 16 in. Pacific Coast motor-tug fitted with an 80 b.h.p. Union engine. Her name is "Petersen 18"

motors taken out and replaced by steam engines. I have made trips on some of them. The "Toiler" and "Fordonian," the latter vessel is now on salt water and has been re-named "Bacoi," while the "Toiler" is now plying the lakes with steam.

The "Toiler," built in Newcastle-on-Tyne, England, by Swan, Hunter and Wigham Richardson, about 1912, was equipped with two 180 B.H.P. Polar two-cycle Diesels built in Sweden. She crossed the Atlantic ocean under her own power and made a few trips, from Port Colborne to Montreal with grain. *In fact she carried 94,000 bushels, through the Welland Canal, the most ever carried by a steamer being 88,000 bushels.* She was the first Diesel-engined ship on the Great Lakes and made the round trip on eight tons of fuel, the distance being 771 statute miles; but, she had to pass through 32 locks each 275 ft. long, 45 ft. wide, with 14 ft. of water over the sills. The ship if I remember correctly was 256 ft. overall, 250' B. P., 42 ft. moulded breadth and 14' draught. You see she is practically a glove fit.

They took her Diesel engines out and replaced them by steam simply because they could not handle her at reduced speeds in the locks. She would not throttle down below 60 R.P.M. which is so necessary in going through the locks, with steam you can turn her over at 20 R.P.M. without trouble but throttle the Diesels to 50 R.P.M. and they would choke and stop, mind you these are old engines and there have been great improvements made since then.

I think there would be a good opening for Diesel engines in Great Lakes freighters, but above all flexibility must be the leading feature. In my opinion a six-cylinder four-cycle developing full-power at 100 R.P.M. and capable of throttling down to 35 R.P.M. would be ideal.

If you have any data on Diesel-engined Great Lakes freighters I would very much like to see same published in your valuable magazine Motorship.

Very truly yours,
J. L. McKENZIE.

409 Markham Street,
Toronto, Canada.

[We have an article on Diesel engines on the Great Lakes awaiting space to publish same—Editor.]

A BRITISH OPINION OF "MOTORSHIP"

To the Editor of "Motorship."
Sir:

Our Managing-Partner Mr. W. C. Pollock, who has made a close study of your paper "Motorship" for some time now, congratulates you upon the masterly way in which it is got-up, and for the really valuable and instructive information it contains, both to the Engine-user, and the Engine-builder. "Motorship" is a paper, which, in his opinion, has a great future before it.

We intend now to become a regular subscriber, and possibly advertiser at an early date. Will you please send us your paper regularly, and we will remit payment.

Yours very truly,
W. & S. POLLOCK & CO.,
Per L. R. Fullerton.

Glasgow, Scotland.

CURRENT REVIEWS

"Janes' Fighting Ships 1918-1919." Edited by Maurice Prendergast, and published by Sampson Low, Marston & Co. Ltd., London, England, Price 30 shillings net. To all interested in naval matters the 1918-1919 edition of "Janes' Fighting Ships" will be most welcome, and considering the unusual difficulties in the way of securing reliable naval information during the war, Mr. Maurice Prendergast is to be congratulated for having brought this latest edition well up-to-date.

Our particular interest is centered upon the vessels propelled by internal-combustion engines, including submarines, and we note that the German submarine section of "Fighting Ships" includes references to the latest craft. The "Weddigen" U-boats are given as having a submerged-displacement of 4,000 tons, and 3,200 tons surface displacement, and a speed of 18-19 knots. Length 361 ft. by 36 ft. breadth and 20 ft. depth. Fitted with Diesel or steam-engines of 7,000 H.P. and electric motors of 3,000 H.P. The U-139 to U-142 are ocean going submarines with Diesel-engines aggregation 4,250 b.h.p. and electric-motors of 3,000 H.P. Length 344 ft. Breadth 34 ft. Depth 20 ft. Speed on surface 16 to 17 knots.

The British war-construction section is particularly interesting and so calls for special mention. Referring to the American built 80 ft. motor launches the Editor says:

"There is a general and somewhat unfair impression current, that these boats have turned out failures. This idea appears to have arisen from the fact that far too much was expected from craft of such small size. Actually, they have proved highly useful during the war, provided they were confined to work not beyond their powers of endurance—as witness the Zeebrugge-Ostend raids."

This endorses the remarks made several times in "Motorship." Our previous suggestion that the British K-Class submarines are steam turbine driven is confirmed by "Fighting Ships." "K-4" and "K-17" were accidentally rammed and sunk by British warships, and "K-13" was sunk on trial as mentioned many months ago in "Motorship." She was raised, repaired, and re-numbered "K-22."

Details are given of the British J-class, Diesel driven triple-screw submarine-cruisers, which are of 19 knots surface-speed. The dimensions given tally with those published in the Naval number of "Motorship" for June 1918 on page 11. It was in this issue that we first referred to the great K-class submarine-cruisers. The largest French submarines referred to are believed to have a submerged displacement of 1,700 tons, and 20 knots speed.

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Are Oil-Engined Auxiliary Sailing-Ships Successful?

Chief-Engineer of the Bolinder-Powered "City of Portland" Reveals an Interesting Record

NO one will dispute that there have been placed in service a number of wooden motor-auxiliary sailing-vessels of large size that have not been completely successful and that others have been total failures. Nevertheless, "Motorship" has consistently contended that the wooden—as well as steel—auxiliary, when properly designed, well-built, fitted with a recognized good make of oil-engine, properly installed and well operated, is a very successful type of merchant-vessel that can compete on the seven oceans against oil-fired and coal-burning steam-driven freighters.

We have just received the following letter from Mr. C. Hugo Hansen, Chief-Engineer of the motor-auxiliary sailing-ship "City of Portland," a vessel of about 5,100 tons loaded-displacement owned by the McCormick Steamship Line, Powell Street, San Francisco, Cal. This letter we have decided to give special prominence for reasons which speak for themselves. This letter we reproduce as follows:

McCORMICK STEAMSHIP LINE
San Francisco, Cal.
Aboard M. S. "City of Portland"
at San Francisco, Cal.

March 3, 1919.

To the Editor of "Motorship,"
New York and Seattle.

Sir:

The performance of the crude-oil engines of the M.S. "City of Portland" from August of last year, and a little of our experience may be of interest to "Motorship's" readers.

From Ambrose Channel, L. I. to picking up pilot off Norfolk, Va., 231 nautical-miles average speed, 8.61 knots. Here we took on a cargo of coal for San Diego, Cal. From dropping the pilot off Norfolk, Va., following coast line, as per instructions from the Government, to picking up pilot off Colon, C. Z., 2,385 nautical-miles, average speed 8.13 knots. Arrived there in the afternoon so could not go through the canal that day, but took on some stores and fresh water.

From anchorage in the Bay at Colon through the canal to dropping last U. S. Naval Pilot off Balboa, 9 hrs. 7 min. From waters of Atlantic to waters of Pacific 6 hrs. 25 min. Stopped about 2 min. in Balboa and proceeded on our way to San Diego 3,242 nautical-miles; average speed 7.89 knots.

San Diego to San Francisco 452 nautical-miles; average speed 7.34 nautical-miles per hr. No sails were set here as wind was unfavorable. At San Francisco Mr. Connanton (who was 1st assistant-engineer on the voyage to the Atlantic and return) became Chief and took the vessel to Portland, Ore. 650 nautical-miles; average speed 7.14 knots. Here we overhauled our Bolinder engines, pulling all pistons, examining all crankpins and brasses, and rolling-out all journals, and it certainly was a pleasure. As Mr. Connanton says it was worth the trip up to Portland just to be in at the overhauling.

The crankpin brasses you would swear had just been scraped-in and only the top ring in the pistons stuck and, this after having run 16,156 nautical-miles from Columbia River, U. S. to Pilot Boat at Shanghai, China, via South of Island of Hawaii, 35 days 13 hrs. 17 min. 6,982 nautical-miles; average speed 8.18 knots. Engines going full-speed all the time.

Here we had a loose coupling on our port tail-shaft that showed up the day before arrival in Shanghai, and if it had not been for this our expenses would have been about $20.00. From Shanghai to Saigon, Cochin, China, 1,574 nautical-miles, average speed 9.64 knots. Here we were in ballast and had favorable winds.

Saigon to Manila via Palawan Passage 1,079 miles by observation speed 6.92 knots 1,258 nautical-miles recorded by log, speed 8.07 knots. From Manila bound for Frisco we went south and got out in the Pacific around 33 N. where we ran into a series of North Pacific winter-time storms lasting about 9 days.

I have seen as bad but not any worse weather, having crossed here five winters. But, through it all the engines never missed a "chug" and like Mr. James E. Cole who says in an article written for "Motorship" some time ago that he would rather be with a Diesel engine in heavy weather than with a steam job. I can say "me too"! The deck department certainly were kept busy taking in sails, setting them again and then have them carried away. We haven't had a full set of sails on since.

From Manila to San Francisco crossing in latitudes 37 and 38 N. 6,563 miles we were 34 days 11 hrs. 37 min., average speed 7.93 knots. During this time our port engine was stopped once for 2 hrs. to renew some broken circulating-water pipes that had let go during the heavy weather and been temporarily repaired, and our starboard engine once for 5 hrs. for same reason, and once for 14 hrs. to drive up the keys in the flywheel. Balance af time running "Full-speed." At Shanghai we received from the Asiatic Petroleum Co. Ltd. 1,005 barrels of 17 gravity at 46 Fahr. crude-oil, which I think comes from the East Indies and we were a bit dubious about it and shaking our heads as it was pretty thick. But Pshaw!—we had no reason to worry as our engines turned-up just as good with it as with the 24 Baume we had been burning, and we rather liked it even in the cold weather.

I have heard of aeroplane motors and racing automobiles being tuned-up, never thought it would apply to crude-oil engines. But it sure does!

While on the steam jobs I always liked to listen to the sharp cut-offs with my ear against the covered exhaust-pipes between the cylinders and also the condensers. So I tried the same stunt on the M.S. "S. I. Allard," where I was 1st Assistant, by listening to the cylinders at the same time opening and closing the scavenging-valves to see what kind of noise they would make, and at a certain point you would get a sharp clear ring like a bell. That did not sound bad at all, so I set them all that way and the ignition-bulbs in which we carried a color cooled down till they were black, but never missed.

The scavenging-valves are in the passage way from crankcase to cylinder and they are just like a damper in a stove-pipe; but, moving this just ⅛in. one way or the other you con lose the ring.

A person would naturally think that when the ignition-bulb was red she wanted more scavenging-air; but, invariably it has been the opposite—and I have seen many a time where the bulb would be cherry red and then some,—the scavenging-valve closed down sometimes completely till you got the ring. In ten minutes it would be black and all the air that would be going in the cylinder would be through a 1/16 in. hole in the injection device at a constant pressure of between 300 and 400 lbs. and that would not be much for each revolution turning from 200 to 300 revolutions per min.

And if you have the ring in each cylinder no matter where you have your scavenging-valves set, you can lay any odds that the exhaust is absolutely clear without looking at the stack.

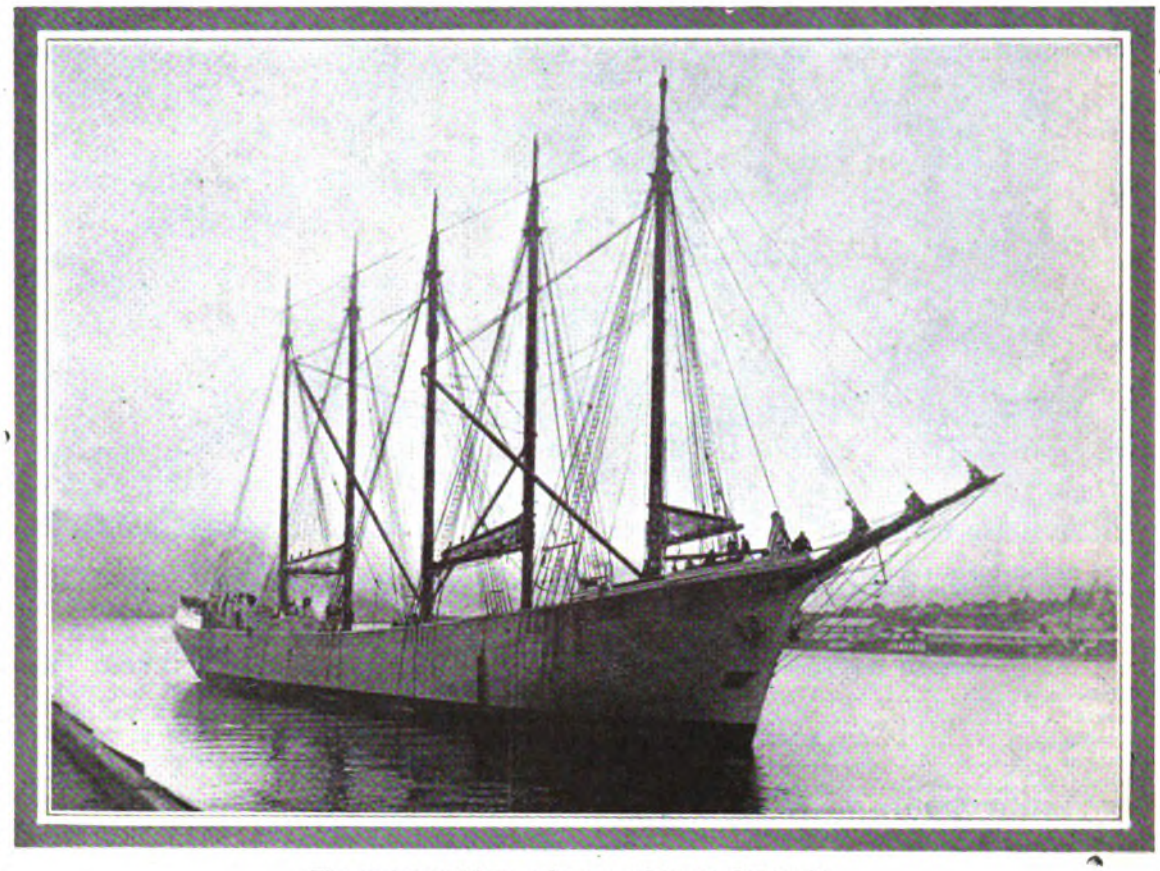
When I came on the "City of Portland" a little over a year ago, I was not sure whether the Bolinder engines in the ship (same as the M.S. S. I. Allard) would develop the ring and when we had our engine trials that was the first thing I looked for. I got it, and was satisfied!

I have passed it on to the assistant-engineers I have had, and this trip when Carter Moran and Steffensen would come off their respective watches, if they were smiling, I'd know they had the ring in all cylinders, if not, it would be number So & So. Port or Stb. dont seem to be percolating just right.

There has been Watch after Watch when a lever has not been touched. Heads all black (No guess work whether they were hitting or not) as long as the ring was there she would be burning every atom of fuel, and we will not get enough carbon out of the exhaust ports and heads when we open up this time to fill a No. 4 scoop and this after running 16,298 nautical miles.

No head troubles no joints blown in this distance, Why! As I heard an engineer say in New York "I am off of steam for life."

Yours very truly,
C. Hugo Hanson,
Chief-Engineer, M.S. "City of Portland."



The motor-auxiliary schooner "City of Portland"

In the August, 1917, issue of "Motorship" a description of the "City of Portland" appeared, and the Superintendent-Engineers for the owners frankly stated that she was underpowered and that future auxiliary vessels built by them would have oil-engines aggregating 1,000 b.h.p. Her dimensions are as follows:

Loaded Displacement	5,100 tons
Light Displacement	1,800 tons
Length	278 ft.
Breadth	48 ft.
Depth of Hold	19 ft. 6 in.
Loaded Mean Draught	22 ft. 4 in.
Fuel-Capacity	1,700 barrels
Fresh Water Capacity	10,000 gallons
Power (Twin Bolinder Oil Engines)	320 b.h.p.
Engine-speed	220 R.P.M.
Builders	St. Helens Ship Bldg. Co.
Average Daily Fuel-Consumption	24 barrels

Without counting fuel, stores and water, the "City of Portland" has carried 2,800,000 feet of lumber, or about 3,300 tons of net-cargo. After the straight-forward narrative of the chief-engineer of the "City of Portland" can anyone say that the oil-engined motor auxiliary sailing-vessel is unsuccessful as a class.

THE AMERICAN 110 FT. NAVAL PATROL BOATS

By authorization of the U. S. Navy Dept., Mr. Geo. Anderson, of 9 Fenchurch St., London, E.C.3, England, is inviting offers for the purchase of a large number of the 110 ft. wooden-built submarine-chaser motor vessels.

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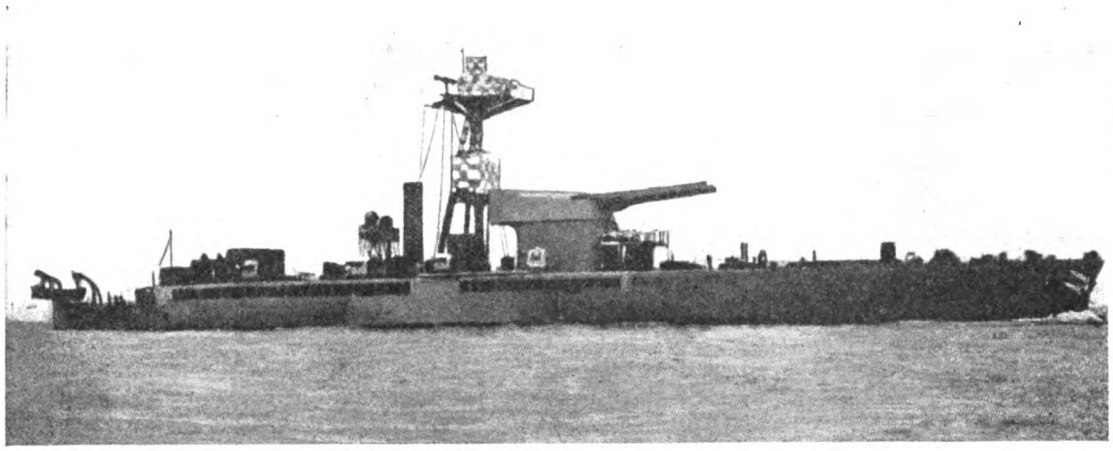
British Motor Warships With 15" Guns

Two Heavily-Armed Diesel-Driven Monitors in Service for Three Years—Another Naval Secret Revealed!

IN previous issues of "Motorship" we have referred to motor monitors in the British Navy, a number of which have surface-ignition oil engines installed. Recently the British Admiralty released details of two large Diesel-driven monitors which are of very considerable interest. They are the "Marshall Soult" and "Marshall Ney," two ships of 6,670 tons each built at Palmers' Shipbuilding yard at Jarrow, England, in eight months. They have the following dimensions:



The British Diesel-engined monitor "Marshall Soult" armed with two 15 in. guns. She did splendid work during the last three years of the war. Her builders were the Palmers' Shipbuilding & Iron Co. of Hebburn and Jarrow-on-Tyne, England

General Dimensions:

Displacement	6,770 tons
Length	355 ft. 6 in.
Breadth	90 ft.
Draught	10 ft. 6 in.
Power	About 2,000 b.h.p.
Number of Propellers	Two
Speed	6.5 knots
Fuel-Capacity	650 tons
Builders of Hull	Palmers Shipbuilding & Iron Co.
Builders of Diesel Engine	Name not available
Armament	Two 15-in. guns; eight 4-in. guns; two 3-in. guns and one anti-aircraft gun
Date placed in service	June and August, 1915

The motor-monitor "Marshall Soult" entered service in August, 1915, and was continually employed in the Belgian coast operations and rendered a very good account of herself, says the "Marine Engineer and Naval Architect" of England; but the "Marshall Ney" suffered from a number of engine-room troubles, and for the last two years has been stationed in the Downs as a guardship. She was first placed in commission in June, 1915.

The original armament of both these motor warships consisted of two 15-inch guns in a raised turret forward. Owing to the necessity for completing the ships quickly, these 15-inch guns and mountings were appropriated from one of the "Queen Elizabeth" class—said to be the H.M.S. "Barham." In the Spring of 1918 four 4-inch guns were added to the "Marshall Soult's" armament, which was afterwards increased to eight 4-inch with two 3-inch and four anti-aeroplane guns. The bridge structure around the foremast was also built up, and the funnel, formerly an insignificant exhaust uptake, was replaced by the present more satisfactory-looking stack.

The "Marshall Ney" underwent considerable modifications in armament as her sphere of activities became circumscribed. About April, 1916, the 15-inch guns were taken out and put into the "Erebus," a single 9.2 inch gun in a shield being substituted and four 6-inch and three 3-inch guns added. The following year the 9.2-inch gun was removed, and two more 6-inch guns mounted instead, one forward and the other aft, and she then was stationed in the Downs in connection with the anti-aircraft and destroyer defence.

On trial the "Marshall Ney" developed 2,200 horse-power, and the "Marshall Soult" developed 1,900 H.P.

In general design these vessels are enlarged "Abercrombies" which class of vessel was illustrated in "Motorship" for February, 1918. They were the first large British surface war-ships to be fitted with Diesel oil-engine power. The illustration depicts the "Marshall Soult" as she finally appeared, with chequer-painted upper works and 3-inch guns on a platform above the conning tower situated immediately forward of the turret. The starboard four 4-inch guns can be seen along the topside and the "A.A." guns on a platform aft, while a smoke-producing "gadget" projects each side of the control top like a large range-finder.

Regarding the M-class of British twin-screw motor monitors referred to in our last issue, there were five sister vessels of 600 to 700 gross tons, all propelled by Bolinder surface-ignition oil-engines, and their speed is given as 12 knots. The latter ranks them as the fastest of the various monitors, including those steam and Diesel driven. Probably this is due to the absence of "blisters" on their sides, fitted on the larger boats as a protection against torpedoes. The "Engineer" of London says that there are numerous vessels belonging to this class, and that these small monitors have done excellent work in many waters since 1915, they having been launched between May and September of that year.

This class of motor-warships is represented by the "M-19," "M-20," "M-23," "M-25," and "M-28," and all were built by Sir Rayiton Dixon & Co., Ltd., Middlesborough, England, as also was the motor monitor "M-24," which was equipped with anti-aeroplane gun. Some of them have been rebuilt and re-armed. For instance the "M-23," which we illustrate, had her forcastle built up and the big gun substituted by a 7.5-inch gun from the battleship "Swiftsure." These vessels draw but 6 ft. of water so have proved exceedingly useful for inshore work off the Flanders coast, in the Aegean sea, and in connection with the Palestine expedition.

BRITISH 18-IN. NAVAL GUNS

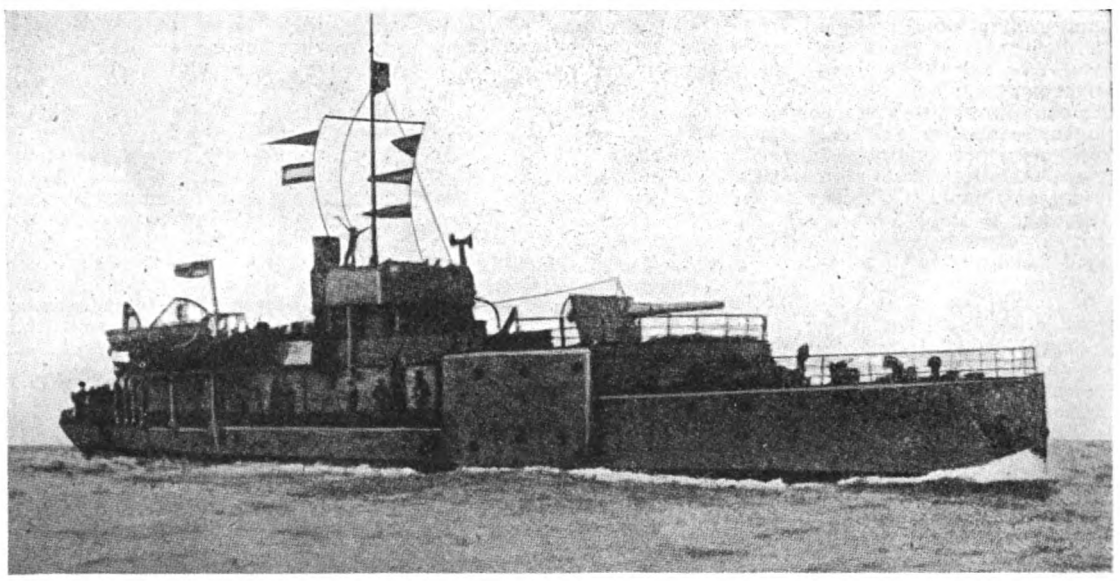
Regarding the 18-inch naval guns carried aboard the British "Lord Clive" class monitor, these are the largest naval guns in the world and were originally manufactured for the battle-cruiser H.M.S. "Furious." As installed aboard the monitors each gun is in a large shield. It can be trained only on the starboard beam with a few degrees of lateral bearing. Consequently the ship has to be maneuvered to bring the sights on to the target. The special mounting allows an elevation of 45 degrees, in which position the gun has a range of nearly 50,000 yards (about 23 miles) for its 3,600 lb. projecticle. The latter, by the way, is equipped with a long "wind cheating" cap. The discharge of this enormous gun had no apparent effect on the structure of the vessel. The "Lord Clive" monitors are of 5,900 tons displacement and of 2,310 H.P. They are steam-driven.

SCOTTISH MOTOR FISHING VESSELS

There are 1,262 fishing vessels in Scotland that are equipped with internal-combustion motors, and of these 274 were added during 1918.

EXTRA PAY FOR ENGINEERS ON BRITISH MOTOR-VESSELS

It is officially announced, says "Shipbuilding and Shipping Record" that the additional pay for engineers on motor-driven vessels of from 1,000 to 3,000 tons gross should be as follows: Chief-engineer, £4; second engineer, £3; third engineer, £2; fourth engineer, £2, and fifth engineer, £2, over and above the National Maritime Board standard rates for steam-driven cargo vessels. This amount to be additional to the special percentages given to engineers on oil-tanks vessels when payable for carrying oil, such percentages to be calculated on the standard rates of pay for steam-driven vessels.



The "M-23," one of the Bolinder-engined motor-monitors of the British navy. She was built by Sir Rayiton Dixon & Co., Middlesborough

internal-combustion engines using producer-gas fuel. They have the following dimensions:

Length	170 ft.
Breadth	31 ft.
Draught	6 ft.
Tonnage	700-800 tons gross
Power	640 shaft h.p.
Speed	12 knots

Their original armament consisted of one 9.2-inch gun, one 4-inch or 3-inch quick-firing gun, and one

VICKERS AND SEWING-MACHINES

Vickers, Ltd., the great British shipbuilders and Diesel-engines constructors are taking up the manufacture of sewing-machines on a new patented principle, which will mean very low production costs. The sewing-machine manufacturing department will take the place of munition work and will not interfere with their normal peace construction.

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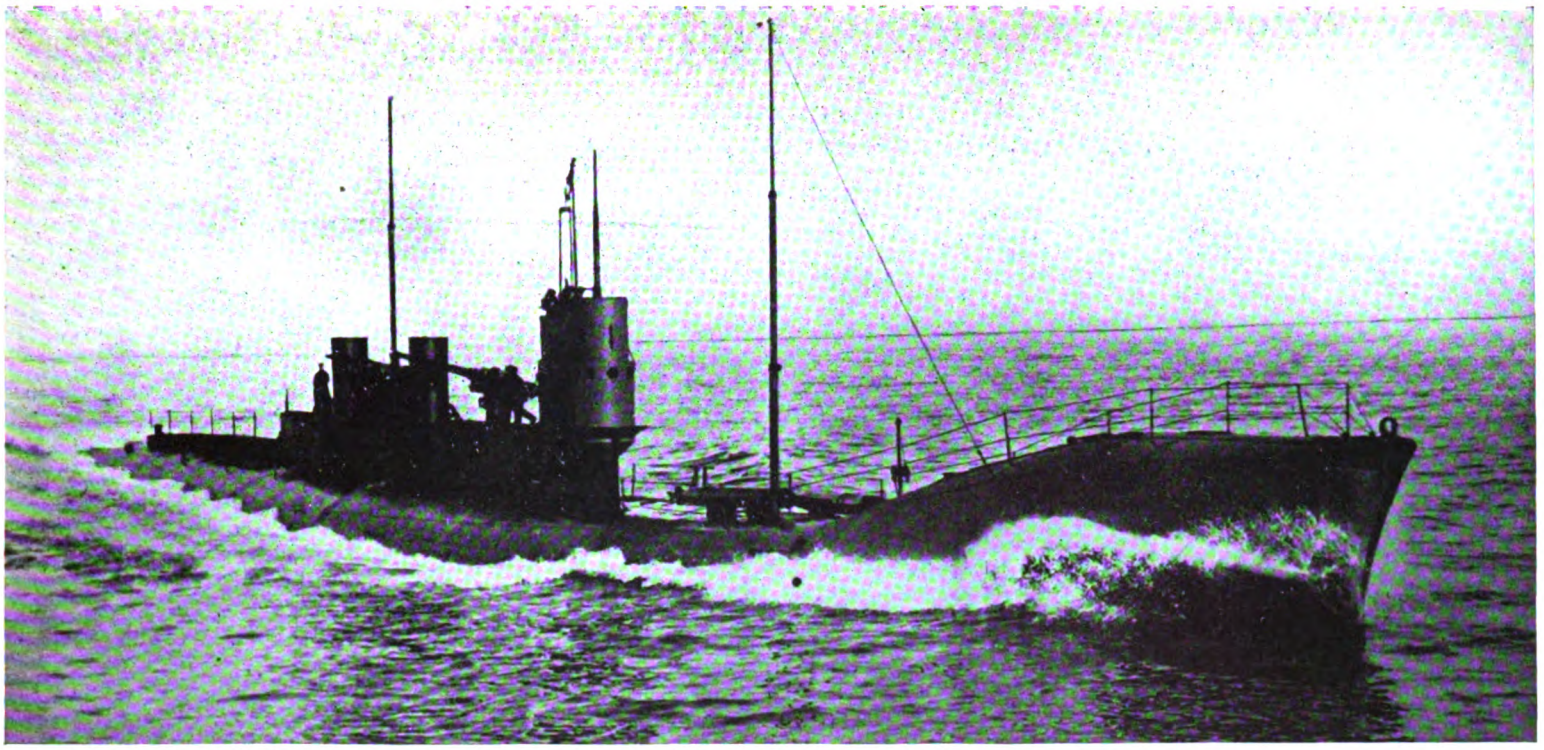

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Close-up view of one of the six British K-class 10,500 H.P. submarine-cruisers. She is driven, when at full speed, by steam-turbines; but at cruising-speed she is propelled by an 800 b.h.p. Vickers solid-injection "Diesel" oil-engine. The first illustration of these boats to be published anywhere appeared on page 21 of the Dec. 1918 issue of "Motorship," and details first appeared in our June, 1918 Naval number.

Vickers "Diesel"-Driven Submarines of the British Navy

Twelve-Cylinder, Solid-Injection, Oil-Engines of 1300-1400 b.h.p.

FOR the first time in history complete details of the Vickers-built British submarines and their solid-injection "Diesel" type machinery have been released for publication, and much of the matter now revealed is in accordance with the various brief details from time to time given unofficially in "Motorship." With acknowledgments to "Engineering," of London, we now are enabled to reproduce some interesting illustrations, and further descriptive matter concerning these Diesel-driven sub-seas naval vessels, and as soon as space permits we intend giving a complete technical description of the Vickers high-powered solid-injection engines of the L-class submersibles.

During the fifty-one months of war, Vickers, Ltd., Barrow-in-Furness, England, completed 54 submarines, including six K-class steam and Diesel-driven submarine-cruisers, 1,570 tons submerged-displacement, 10,500 shaft-horse-power, and 24 knots surface-speed. In these great submarines an 800 b.h.p. Vickers "Diesel" oil-engine is used for cruising, and for charging the batteries that are required for furnishing current to the electric motor which is needed for under-water operation. On this page is a table giving details of most of the submarines built by Vickers:

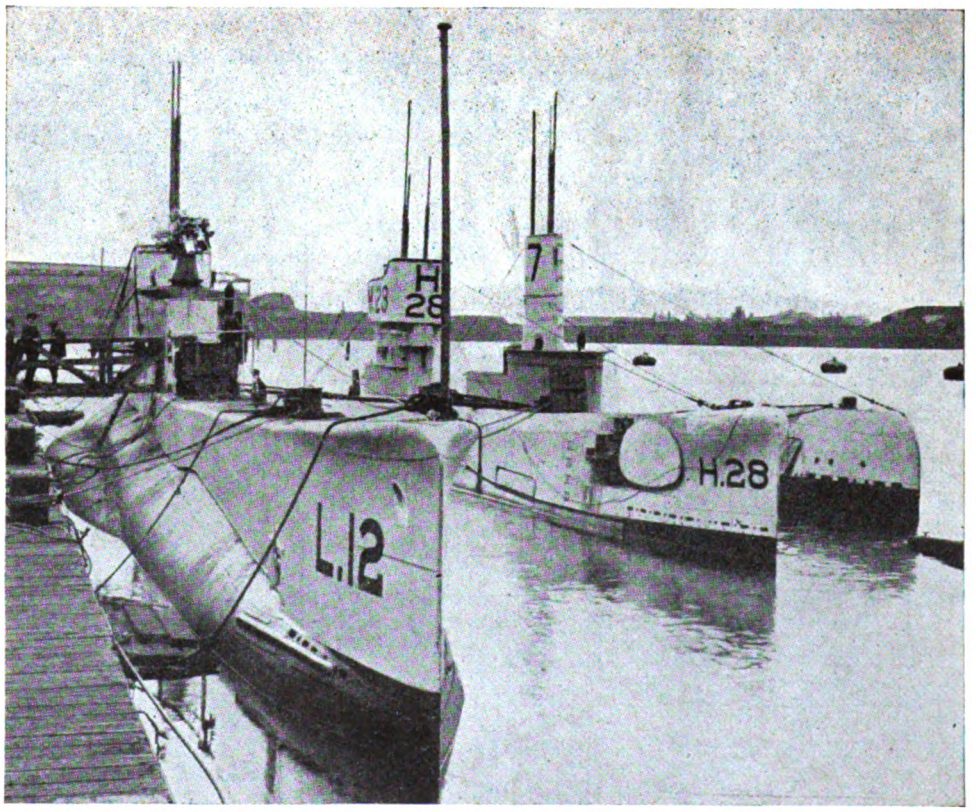
All the above craft are Diesel-propelled, with the exception of the K-class, which as just mentioned are fitted with a 700 b.h.p. "Diesel" engine for cruising and for battery charging. So far as we have been able to ascertain the Vickers submarines are the only naval craft to be fitted with twelve-cylinder "Diesel" engines, although the American fleet-submarine A.A.1 has two 6-cylinders 1,000 b.h.p. Nelseco-Diesel engines coupled in tandem on each of the two propelling shafts.

But each of the Vickers units consists of one 12-cylinder engine, 14½ inches bore by 15 inches stroke, which without effort develops 1,200 b.h.p. at 350 r.p.m.; but, as high as 1,800 b.h.p. has been obtained at higher speed, the low rating, of course, resulting in great durability. In the boats about 1,400 b.h.p. is developed at full-speed. This is equivalent to about 1,900 I.H.P.

These engines are of the solid-injection type, so we are not a little surprised to learn that the fuel-consumption is about 0.4 lb. per brake-horse-power per hour, and that as low as 0.381 lb. has been recorded at full load on official trials. The weight per b.h.p. at the normal rating of 1,200 b.h.p. is 58 lbs. per b.h.p., which is remarkably light for four-cycle heavy-oil engines, and of course is partly due to the absence of air-compressors. Unfortunately, we are obliged to hold-over a technical description of these interesting engines until a later date, owing to very great pressure on space.

Class.	Number Built.	Submerged Displacement in Tons.	Shaft-Horse-power.	Surface Speed in Knots.	Length.	Breadth.
K	6	2,570	10,500	24	339 ft. 0 in.	26 ft. 8 in.
L	9	1,090	2,600	17	238 ft. 6 in.	23 ft. 6 in.
J	3	Dimensions not yet revealed, but are fastest Diesel-driven craft in world. Are fitted with three sets of Vickers "Diesel" engines. Hulls built at Royal Dockyards. Said to be of 1,420 tons surface-displacement and 19 knots speed (See "Motorship," page 11, June, 1918). Probably have three 12-cylinder 1,300-1,400 b.h.p. engines installed giving a total of about 4,000 b.h.p.				
G	6	840	1,600	15½	187 ft. 0 in.	22 ft. 8 in.
E	15	780	1,600	15	181 ft. 0 in.	22 ft. 7 in.
*H	10	510	960	13	171 ft. 9 in.	15 ft. 9 in.
N	1	Details not yet revealed. Probably a large Diesel-driven experimental cruiser.				
V	4	460	900	13	147 ft. 6 in.	16 ft. 3 in.

*Similar to 10 submarines furnished for America by the Submarine Boat Corporation, which were powered with Nelseco Diesel engines.



The L. & H. Class British "Diesel" driven submarines. The L-Boats are of 1090 tons submerged displacement and of 2,600 b.h.p. The Vickers engine is illustrated on the next page

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The New Motor Vessels "Thuban" and "Ursa"

By L. B. JACKSON

Member Amer. Soc. Mech. Engrs. Member Diesel Engine Users Assoc. of England.

The boat illustrated and described in this article is used for the distribution of petroleum products in bulk and in packages. She was built for the Texas Company by The Texas Steamship Company at Bath, Maine. She and her sister boat the "Ursa," have the following dimensions:

Length (B. P.).....91 ft. 6 in.

The Craig-Diesel engined motor vessel "Thuban," owned by the Texas Company

Length (O. A.).....101 ft.
Beam .....23 ft.
Draft .....9 ft. 6in.

They have three pairs of cargo tanks, a small cargo hold forward and the space between decks amidships for cases or barrels. The fuel tanks are located just aft of the cargo tanks and the pump room is above the fuel tank. The after bulkhead of the fuel tank and pump room forms the forward bulkhead of the engine room.

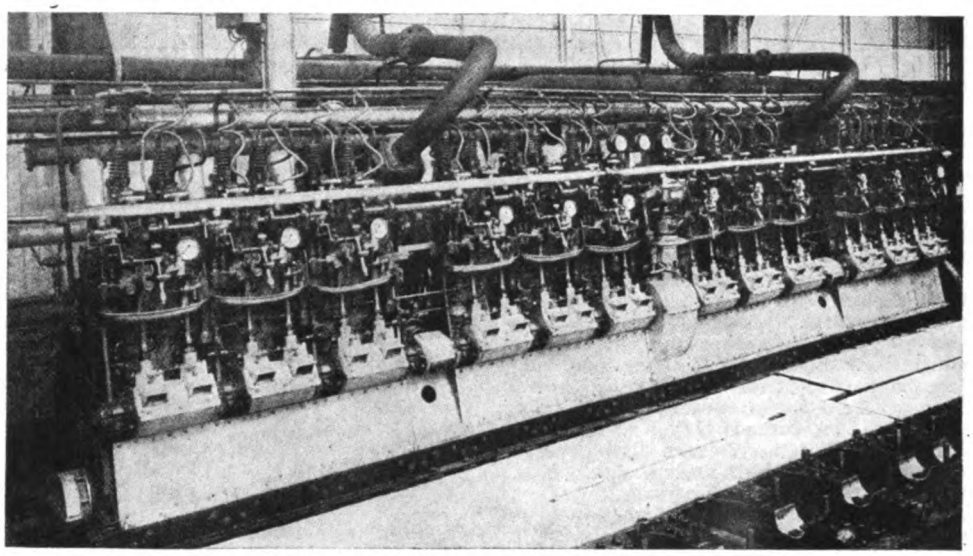
These boats are propelled by a 250 B.H.P. 6-cylinder, 12½ in. x 15 in. 4-cycle, 250 R.P.M. Craig-Diesel engine turning a three-bladed propeller of 60 in. diameter and 54 in. pitch. This engine has a fuel-consumption of less than 0.5 lbs. per B.H.P. hour and has been run satisfactorily on an 18° Beaume oil.

The general arrangement of the engine-room is clearly shown by the illustration. The auxiliary on the port side consists of a small gasoline engine direct connected to a 10 K. W. generator, an auxiliary compressor and a bilge and fire pump. The operating platform, switchboard and seachest and strainer are also visible. On the port side of the engine may be seen the hand fuel transfer pump used for filling the overhead fuel service tank.

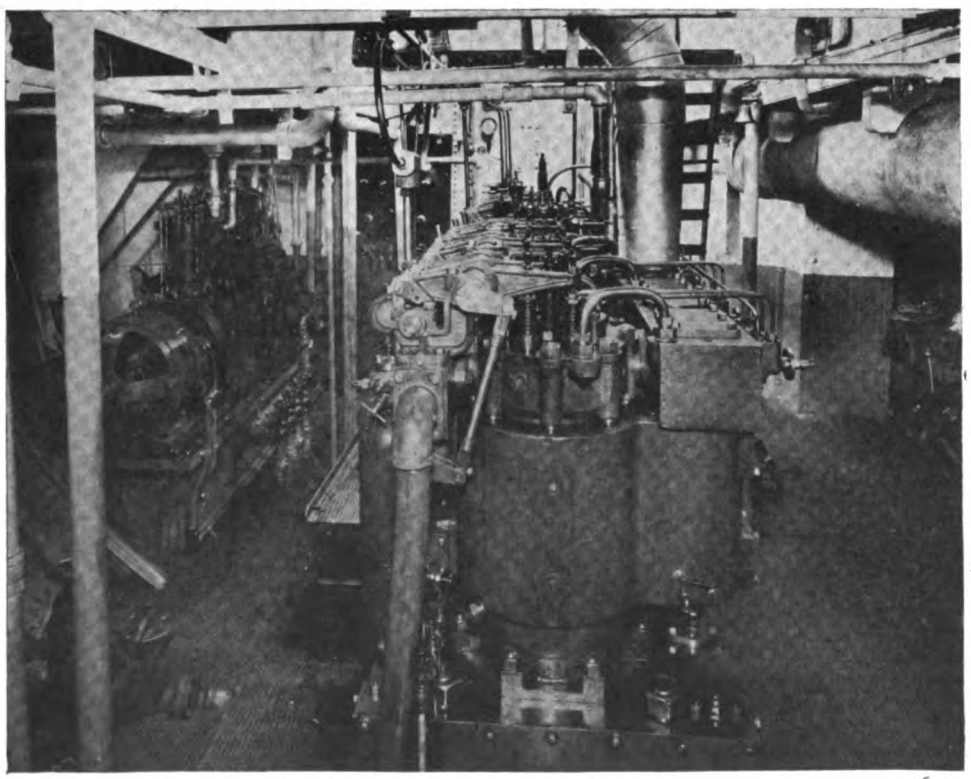
The oil is pumped from the cargo tanks by three Gould Pyramid pumps having a capacity of 12,500 gallons per hour each. These pumps are chain-driven (through clutches) by an overhead countershaft, which in turn is driven by an oil-engine located on the main deck in the engine-room. This machine is a single-cylinder 15 B.H.P., 8½ in. x 10 in., 400 R. P. M. Fairbanks-Morse oil-engine with air and electric hot plug starting.

Under actual operating conditions these boats have shown a speed of 9.2 knots running light and 8.25 knots loaded. The crew of each boat consists of Captain, Engineer Oiler (and Pumpman) Cook and Deck-Hand. No fuel is wasted keeping up steam in boilers as would be the case with a steam delivery boat and the engines are always ready to start on a few minutes notice. The quarters which are unusually roomy and comfortable are heated by electricity supplied by the auxiliary set.

L. B. JACKSON.



The Vickers 12-cylinder, 1300-1400 b.h.p. four-cycle type solid-injection "Diesel" submarine engine



The engine-room of the motor vessel "Thuban"

NEW FRANCO-TOSI BRITISH LICENSEE

We learn that Messrs. William Beardmore & Company, Ltd., of Dalmuir, Glasgow, the well-known British marine engineers and shipbuilders, have entered into an arrangement with Messrs. Franco-Tosi, of Legnano, Italy, whereby they will construct the Tosi four-cycle type Diesel marine oil-engine under license.

ROYAL DUTCH PURCHASES MEXICAN EAGLE

Simultaneously with the formation of the American Petroleum Association by the leading American oil companies, came the announcement that the Royal Dutch Petroleum and its sister company, the Shell Transport and Trading Co., have purchased Lord Cowdray's Mexican Eagle Company for about $75,000,000.00 on a basis of 60 per cent. and 40 per cent., respectively. The Cowdray interests acquired represent about 800,000 acres of oil-land in Mexico, and we presume that the large Eagle fleet of oil-tankers will be included. This, of course, greatly strengthens the arm of the Royal Dutch interests, who have large holdings and refineries in the U. S. A., also a large fleet of Diesel-driven motor tankers, the operation of which will appear in an early issue of "Motorship." Prior to the war the Royal Dutch, it is said, had strong German affiliations, the Deutsche Bank then being interested in their extensive Roumanian holdings, but the British Government and the British Admiralty now are large stockholders in the Royal Dutch and have control of one of its subsidiary companies.

Plans have been adopted by the Corona Oil Company, which is a Royal Dutch subsidiary, for an extensive marketing of its production in the Tampico fields, and it is stated that a fleet of the Anglo-Petroleum Co.'s tankers will soon be placed in the Tampico service. But, it has not been announced if this company will use its Diesel motor-propelled boats in this service.

PISTON-SPEED OF GERMAN SUBMARINE ENGINES

Some of the German submarine Diesel engines have piston-speeds up to 1,323 feet per minute.

LARGE DIESEL-DRIVEN FISH CARRIER

Now under construction at Sandhaven, Scotland, is a large Diesel-driven fish carrier, which is of special interest because we believe that it was intended to construct this and sister vessels in Newfoundland. In fact, a report reaches us that the sister vessels are under construction in Newfoundland.

This new motorship is of 700 b.h.p. and is of composite construction. Her length is 170 ft. by 25 ft. beam, and her power will consist of twin Polar-Diesel reversible oil engines of 350 b.h.p. each, designed to use the heaviest grades of crude-oil. These are expected to give the ship a speed of 13 knots.

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New Danish Motor Tanker

East Asiatic Company's First Holeby Diesel-Engined Oil-Carrying Ship

NOW under construction at the Nakskov Shipyard, Copenhagen, Denmark, is a twin-screw steel tanker of 4,700 tons d.w.c., which is being built to the order of the East Asiatic Company, who control the plant in question. This vessel is being equipped with two 800 B.H.P. Holeby-Diesel engines of the single-acting, direct-reversible, crosshead, four-cycle type, constructed at the new Danish Diesel Motor Works, that are controlled by the East Asiatic Co. and the United Steamship Co. of Copenhagen. Each engine has six cylinders, 19¾ in. diameter by 29½ in. stroke, and develops its rated power at 140 R.P.M. Like with the earlier B. & W. Diesel engines, oil is used for cooling the pistons. The tanker has the following dimensions:

Dead-weight capacity	4,700 tons
Length	300 ft.
Breadth	44 ft.
Depth	38 ft.
Power	1,600 shaft h.p.
Speed	10½ knots

Although the marine engines are of the four-cycle type the two auxiliary Hoelby-Diesel engines are of the two-cycle type, and each develops 100 B.H.P. at 300 R.P.M. They are coupled to 70 K.W. electric generators, the latter supplying current for the electrically driven auxiliaries as well as for lighting. Two centrifugal-pumps driven by electric motors, supply the cooling-water for the cylinders and exhaust manifolds of the main engines. The forced-lubrication system of each engine is supplied by two gear-type pumps driven by electric motors, which draw oil from the bottoms of the crankpits and deliver it through filters to the engines. Both the cooling-water and lubricating oil pumps are of such a size that one is of sufficient respective capacity to supply both engines in cases of emergency, and the piping is inter-connected to allow of this being done.

On the port side, abaft the electric generating set is a two-stage stand-by compressor, direct-coupled to a 50 B.H.P. electric-motor. In addition there is a steam-driven emergency compressor right astern between the propeller-shafts, where will be found also a ballast-pump with a capacity of 100 tons per hour, which is driven through gears by an electric motor. A bilge and sanitary pump of the reciprocating type, and electrically driven is on the starboard side of the engine-room. Besides these various pumps there are electrically-driven fuel and oil pumps for filling the daily running tanks.

A marine-type donkey-boiler, which is arranged on the deck above the thrust-blocks, supplies steam for the deck machinery and for heating the living accommodation in the ship. Three steam winches and an anchor windlass are fitted on deck whilst the steering-gear is of the electric-hydraulic type. Fuel-oil is carried in the double bottom under the engine and in an oil-tank at the forward end of the engine-room, the capacity of the former being 100 tons, while that of the latter is 230 tons, this being equivalent to a total of 1,980 barrels. We presume that this vessel will be used for the purpose of transporting oil-fuel for the large fleet of motorships built and building for the East Asiatic Company.

COCKERILL'S WORKS AND GERMAN KULTUR

Before the war the Seraing works of the Société Anonyme, John Cockerill, who also have a shipyard at Hoboken, Antwerp, Belgium, employed 11,000 hands. Among their engineering products they constructed marine Diesel-engines. During the war the Huns removed over 1,000 machines, tools, cranes, etc., and raw material and shipped the same to Germany. What they could not take they destroyed, and then they dynamited the mills and furnaces, but left the buildings fairly intact, a special devastating commission having been sent from Germany for that purpose. Mr. Leon Greiner, the director-general of Cockerills was arrested three times and twice faced a firing-party, but the sentence each time was countermanded. He estimates that restoration of this work and shipyard will take three years and will cost $10,000,000.00. "Syren and Shipping" of London for February 5th contains some pictures of the devastated works at Seraing. Here may be excellent opportunity for some large American engineering company to exhibit true friendly spirit by offering to rebuild the Cockerill plants at cost, or cost plus 5%, in recognition of the gallant men of little Belgium.

INDIAN GOVERNMENT ENCOURAGES AUXILIARY MOTORSHIP CONSTRUCTION

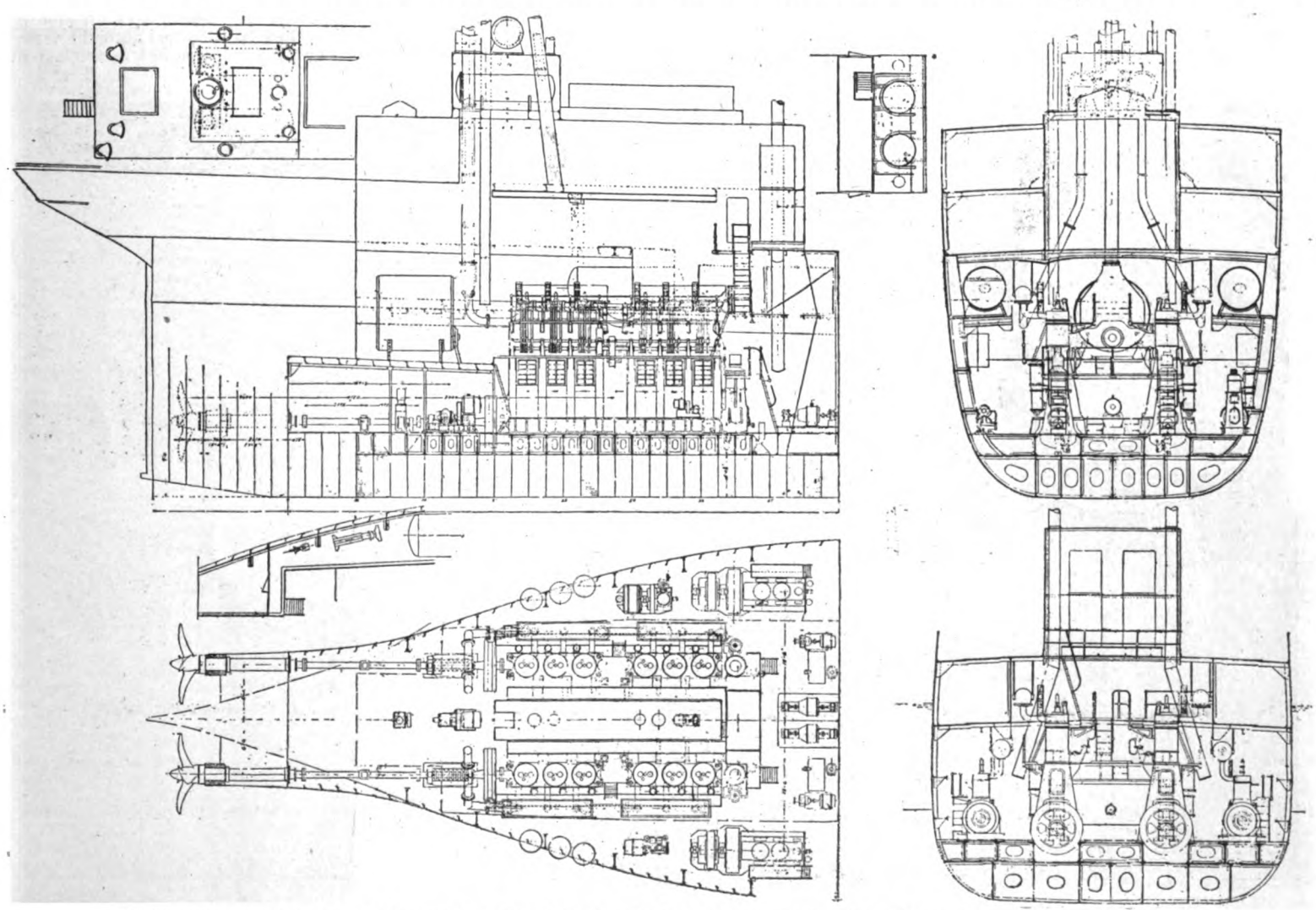
The ship-building department of the Indian Munitions Board is encouraging the construction of motor-driven auxiliary sailing vessels, and with that end in view the Board is supplying working drawings at very low cost.

STEAM FERRY CONVERTED TO MOTOR POWER

From 1891 to 1918 the ferry-boat "Lubec" running between Eastport, Me., and Lubec, Me., was steam propelled. But, since early last year she has been driven by a 100 B.H.P. Fairbanks-Morse surface-ignition type oil-engine on a consumption of fuel-oil equivalent to about one-fourth of the coal previously burned. Her length is 70 ft., by 18 ft. breadth, and 6 ft. 3 in. draft. She carries 305 passengers in addition to a general freight.

CONSOLIDATION OF DANISH SHIP MOTOR INDUSTRY

The outcome of lengthy negotiations between the Dansk Diesel Motorverk (founded last Spring) and Burmeister & Wain, is that the latter firm retains its monopoly. The Dansk Diesel Motorverk, says a British contemporary, had proposed to erect a large motor factory near Copenhagen, primarily because Danish owners could not secure motors quickly enough, and felt some dissatisfaction that under these conditions motors should continue to be supplied to foreign purchasers. The new agreement has entitled those owners who participated in founding the Dansk Diesel Motorverk to obtain motors from Burmeister & Wain. The yards concerned are the Helsingörs and Nakskow concerns and the Kjöbenshavn Flydedok. The Dansk Diesel Motorverk (which has acquired the Guldborg and Holeby motor works, building small Diesel and hot-bulb engines), is not being dissolved, but Burmeister & Wain are controlling the division of work between the several shops, which will now have the benefit of this firm's experience.



Engine-room arrangements of the motor tanker built for the East Asiatic Company in Denmark, and fitted with twin 800 b.h.p. (1,050 I.H.P.) Holeby-Diesel oil-engines

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New Marine Oil-Engine Works

American Plant of the Gulowsen-Grei Engine Company Just Completed on the Pacific Coast

IN connection with the development of the marine oil-engine and the merchant motorship, not a little credit must be given to the two Scandinavian countries, namely, Norway and Sweden, for it was the enterprise and foresight of their shipowners and those of Denmark that have been partly responsible for the interest taken in the subject in the United States. Particularly on the Pacific Coast has the energy of Norwegian and Swedish interests made itself felt not only by the ordering of many motorships, but by the laying-down of factories building oil-engines from American labor and with American tools and materials by the aid of Scandinavian marine engineering experience.

The latest example of Norwegian enterprise is demonstrated by the recent formal opening of the new marine oil-engine works of the Gulowsen-Grei Engine Company builders of the Gulowsen-Grei motor at Seattle, Wash., in which over $750,000.00 in cash has been invested to date. The new works are associated with the firm of A. Gulowsen A/S, the well-known Christiania marine engineers whose oil-motor since 1893 has been the standard of the Norwegian fishing fleet, their Norwegian factory having an annual output of 20,000 b.h.p. The president of both the American and European companies is Mr. Anders Gulowsen. At Seattle, Mr. A. C. Rossoe is the vice-president and general-manager.

Undoubtedly this is an important addition to the domestic marine engine industry, as the plant is entirely new and equipped with the best of new and modern American machine tools. No old buildings or machinery were converted, but a suitable site was found, with proper sail and water facilities and entirely new buildings erected.

The new plant covers a site of six acres and is located on the shores of Salmon Bay just inside of the government canal locks, where it is accessible to deep sea shipping of all kinds, and where fishing boats from Puget Sound can readily land at its docks for engine installation or repair. It is without doubt one of the largest and most complete internal-combustion engine factories on the Pacific Coast. The present plant consists of three large buildings, the main machine-shop, the pattern-shop and the foundry, in addition to which there are the usual oil, sand and coke sheds, etc.

The main building is 350x175 ft. and contains the machine-shop, assembly department, test-rooms, paint-shop, tool-room, repair department and stock-rooms in addition to the company's offices, which consist of the factory office, administration office and the engineering department.

ANDERS GULOWSEN

Founder of the Gulowsen Engine Company of Christiania, Norway, and President of the Gulowsen-Grei Engine Company of Seattle, U. S. A.

The machine-shop has electric traveling overhead cranes in every department.

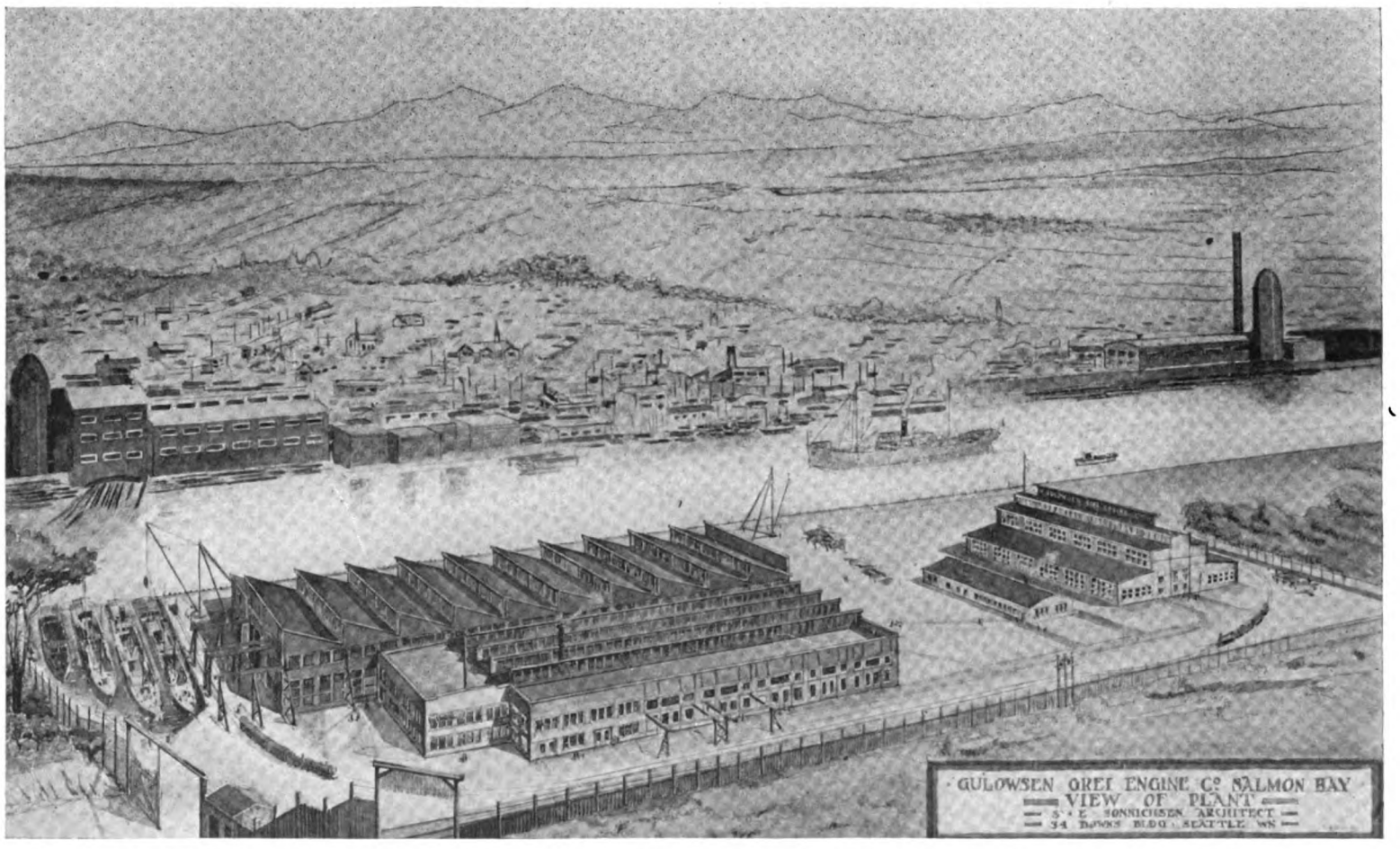
The foundry is 100x150 ft. in area and is pronounced by those who have seen it as the finest foundry of its kind on the Coast. In fact, this plant is unique in that it is one of the few internal-combustion engine factories in the United States having its own foundry and making its own castings. But, we are glad to say that the number of oil-engine builders adding foundries to their plants is increasing as rapidly as they realize the great importance of this department. This is one of the features which the plant at Christiania has specialized in, and the founders of the Seattle factory insisted that the traditions of the Norwegian plant in turning-out the very highest possible grade of castings of special mixtures should be maintained by the new plant at Seattle. The Seattle factory is therefore equipped like that at Christiania to make all of the castings needed in the manufacture of the engine. One of the special features of the foundry is the sand-blast equipment for cleaning the castings.

The pattern-shop which is 30 ft. by 100 ft. in size is well equipped, not only to handle all the work in the production of present models, but for any experimenting that the company may wish to do in the production of engines of different size and design. In fact the Seattle company already are producing a new engine of larger size than anything yet built in Christiania. A special feature of this department is the fact that all the transmission for the woodworking tools is located in the basement leaving the pattern shop itself free from all belting and transmission.

Everything about the entire plant in fact is conceived on an equally extensive and yet compact and convenient scale, and no feature of equipment has been omitted that will tend to the production of the oil-engines on a large and yet an economic basis.

The plant at present employs 300 men and already the factory is working on the production of ten 80 h. p. engines especially designed to take care of the demand from the owners of cannery tenders tug boats and other good-sized boats. Several 240 h. p. direct reversible engines are also in course of manufacture for installation in motorships and very shortly the factory will start manufacturing the full line of motors, which will range in sizes from 15 h. p. to 550 h. p.

The engines to be turned out by the new factory are known as the "G-G" heavy oil motors and are of the surface-ignition or hot-bulb type but are being equipped with a new electric starting de-



Birds-eye view of the Gulowsen-Grei factory showing its position on Lake Washington canal near Salmon Bay, and the excellent deep-water and railroad facilities.—Note the adjacent fitting-out dock. Salmon Bay is the greatest rendezvous for motor fishing-vessels on the Pacific Coast

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Some of the new buildings of the Gulowsen-Grei engine works

vice to be used on all sizes, which does away with the necessity of torches and pre-heating.

While the new Seattle works were in course of erection, the company has been delivering engines carried in stock at New York, which engines were built in Norway. Some of these engines still are available for those who need immediate delivery. It is the company's intention to maintain selling headquarters both in Seattle and in New York City, the eastern office to handle all of the Atlantic Coast territory and the export trade to Atlantic ports while the western office will handle all of the West Coast business and the Pacific export field. Good agents are desired in all seaport towns along the coast.

A few references to some of the more important machine-tools will give an idea of the capacity of the plant. These are as follows: One Dill 15 in. Slotter, one No. 2 Van Norman "Duplex" Miller and extra equipment, one 60 in. x 60 in. x 15 ft. Ingersoll slab miller, one 24 in. x 96 in. Norton Grinder for grinding the crankshafts. Two 48 in. x 24 ft. American heavy-duty engine lathes, three 24 in. x 12 ft. American heavy-pattern lathe, three 18 in. and three 16 in. American lathes, One No. 2A Warner and Swasey geared-head turret-lathe, 1-6ft. American plain radial-drill, one 5 ft. full Universal radial-drill and various other tools of various sizes such as Surfacers, Sanders, Embossing machines, Shapers, mortisers, lathes and drills. Also there are one Heald Style 16in. Rotary-Surface Grinding-machine, one 36 in. Bullard Vertical Turret-Lathe, one No. 3 Cincinnati plain high power and one No. 3 Universal power milling machines, three, 20in. x 12 in. and two 20 in x 14in. Lodge & Shipley selective head engine-lathes, and one Landis horizontal boring, drilling and milling machine. A 24 in. Steinle full swing side-carriage turret-lathe, and a Conradson 42 in. x 36 in. x 8 ft. heavy multi-speed planer.

Before deciding upon the Pacific Coast for their American factory, Mr. A. Gulowsen and Mr. O. Rossoe carefully investigated the oil-engine situation and the manufacturing conditions of this country. After going over the situation they came to the decision that a very favorable opportunity did exist for the manufacture and sale of an engine such as theirs. They visited practically all the important manufacturing points in the United States considering the while of manufacturing facilities and market conditions of the different localities. The last place they visited was Seattle where they found that although manufacturing facilities there were not so favorable as in some places they had visited, nevertheless, the propinquity to the Pacific Coast fishing industry and the active state of motor shipbuilding along the coast more than over-balanced this temporary disadvantage.

Port or Valve Scavenging

[*Now that the question of four-cycle versus two-cycle oil-engines has again come strongly to the fore the following contentions, which we have extracted from a recent issue of "Motorship and Motorboat' of England, will be of considerable interest. These various technical questions which from time to time come up for discussion make desirable—as we previously have indicated—an international oil-engineering convention, and we suggest that the proposal should be taken in hand by one of the well-known American engineering societies. Among other subjects the following could be thoroughly debated at such a convention by the leading Diesel engineers of the World; namely Two-cycle versus Four-cycle; The Size Limits of Trunk-piston Construction; Enclosed or Open Frame Engines; Oil or Water Cooling of Pistons; Cast-iron or Cast-steel Cylinder-covers; Sight-feed or Forced-Lubrication; Port or Valve Scavenging; Scavenging-Pumps or Blowers; Built-up or Solid Forged Crankshafts, etc.*—Editor.]

Discussion on the relative merits of the two and four-stroke types of Diesel engine is ever rife, and will no doubt continue until it is discovered that they both have their uses. It would be more profitable, perhaps to concentrate attention on the means of improving each type rather than towards the discovery of demerits in each. The four-stroke motor is now a well-established success, and all the improvements it needs refer to details and its construction in much larger powers.

The two-stroke machine as built by many firms has been a failure, and as built by others a complete success. Those who wish to condemn it, perhaps not from an entirely unbiased point of view, naturally deal only with the failures and omit the successes. An examination of the whole matter will show that, actually, the position is most hopeful and promises very well for the two-stroke Diesel engines in the future.

In examining the history of this motor it is not difficult to discover that practically all the troubles that have been experienced have occurred with machines of a type with one essential similarity, although perhaps possessing minor features of difference. This similarity lies in the common adoption of valve-scavenging in contra-distinction to port-scavenging, these two systems representing the two cardinal classes of Diesel engines of the two-stroke design.

These facts alone would seem to suggest that the future of the two-stroke motor lies with the port scavenging type; but, actually we have gone much further than that, and there are now direct evidences that the valve scavenging motor will die a natural death and the type with ports in the cylinder walls be almost unanimously adopted.

With these evidences it is safe to say definitely that there is little scope for the ordinary valve scavenging Diesel motor when everything points so definitely to the complete success of the valveless type. It is therefore extremely desirable that British manufacturers who have tied their interests so largely to the valve-in-the-cover system should reconsider their position, cut their losses and prepare for the manufacture of a Diesel engine which has proved so clearly that it can be built successfully in sizes much larger than have hitherto been contemplated with four-stroke machines. This is a point of importance for British firms, since there is no doubt that it is their hope to be able to construct larger and faster motor-vessels than have yet been built by foreign shipbuilders.

SAIL TO AUXILIARY POWER

The British sailing vessel "Vonin" has been purchased by Mr. A. E. Fletcher, fitted with an auxiliary oil-engine, and renamed "Arlette."

NEW LICENSEES FOR WERKSPOOR DIESEL MARINE ENGINES

The Aktiebolaget Bofors Gullspang, Karlskoga, firms which is one of the largest Ordnance works in Sweden, is about to take up the construction of merchant Diesel engines on a large scale, and for this purpose have entered into license agreement with the Werkspoor Engineering Works of Amsterdam, Holland.

BRITISH DIESEL-ENGINE BUILDERS PURCHASED

The Northumberland Shipbuilding Company have purchased the firm of Wm. Doxford & Sons Ltd., Sunderland, England, for about $15,000,000.00. The standard 11½ knots cargo motorships now being built by Doxford are being fitted with engines which have a greater output for cylinder than any other marine Diesel engines known to be under construction.

PERFORMANCE OF THE "GEORGE WASHINGTON"

Owing to the very great pressure on our space this month, we have been obliged to hold over until our May issue, the conclusion of the U. S. Emergency Fleet Corporation's report on the above motorship.

ANOTHER SCANDINAVIAN CONCRETE MOTORSHIP

There has just been completed for Spanish owners the concrete motor-ship "Nicanor" at Moss, Norway. She is a vessel of 200 tons d.w.c. and is fitted with a 100 horse-power Tuxham surface-ignition type oil-engine On trial she attained a speed of 8 knots.

MOTOR-POWER AND THE ZEEBRUGGE RAID

In the Zeebrugge raid the following internal-combustion engined vessels were engaged:

Monitors	about 6
Motor Launches	62
Coastal Motorboats	24
Submarines	2
Total motor craft	94

MOTORSHIP BUILDING OUTLOOK IN GREAT BRITAIN

From a recent issue of the "Liverpool Journal of Commerce" we cull the following:—

"Notwithstanding, however, that Diesel engine construction in Britain has of late been in a backward state, as compared with certain other countries, British shipowners are not altogether blind to the fact that for service on many of the world's routes the motor ship is a much better business proposition than the steamer. There are indications that before long we in this country will see a big revival in motor shipbuilding and due attention given to the development of the marine Diesel engine."

POSSIBILITIES OF MOTORSHIP BUILDING IN NEW YORK DISTRICT

Among American steel-ship building companies who have been closely watching the progress of the Diesel-driven motorship is the Downey Shipbuilding Corporation of Staten Island, New York. This company recently launched the steamship "Dochet" of 7,800 tons d.w.c. for the Emergency Fleet Corporation and owing to the unusually high percentage of completion before launching, her outfitting and delivery is expected to be completed in record time. The percentage of completion at launching was as follows: Ship Riveting 99%, Steel Hull Construction Work 93.39%, Machinery and Piping System 76.62%, Outfitting 15%.

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"Motorship" Illustrated Patent Record*

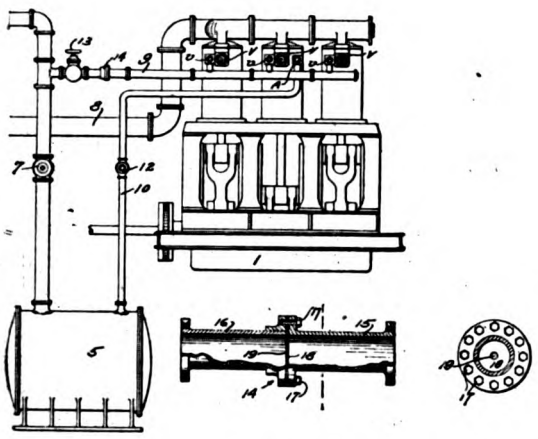
Selected Abstracts of Recent Published Patents of Internal Combustion Engines

Copies of original specifications may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

*Compiled and described by H. Schreck, Member American Society Mechanical Engineers

1,289,689. Dec. 31, 1918. Spray-Valve Control. G. C. Davison, of New London, Conn. Assignor to Electric Boat Co. of New London, Conn.

This invention relates to a process improving on the feeding of the oil to the spray-valve of a heavy-oil engine, while starting up such engine. The compression pressure of a Diesel-engine is set to about 450 lbs., whereas the pressure of the injection-air varies from about 850 to 1,000 lbs., according to speed and load of the engine. While injecting the fuel into the cylinder this air or, better, the mixture expands down to the pressure in the cylinder, and thus lowers the temperature below the burning point of the fuel.

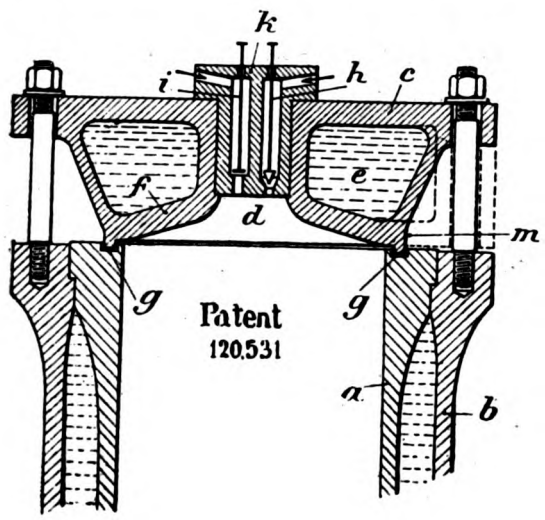


This chilling of the mixture does very little to affect the ignition when the cylinders are in a heated condition, but when the engine is cold, that is, while starting, this effect can result in failure of ignition. This difficulty the inventor intends to overcome by interposing a nozzle plate 18 at flange 14 of the air injection line 9. After the engine is started on air, valve 13 will be opened and on account of the said nozzle the injection-air pressure in line 9 will only rise gradually; that is, it will control the pressure of the air in such a way that during the first injections of fuel the injection-air pressure will be less than during the later ordinary operating condition.

In the illustration, pipe line 8 supplies the air to the scavenging valves V, the line 4 carries the starting and injection-air from the compressor, and line 10 the starting-air to starting-valve A.

120,531. 1918. Cylinder Cover. B. E. D. Kilburn, of London, England, Assignor to Sulzer Bros., Switzerland (British Patents).

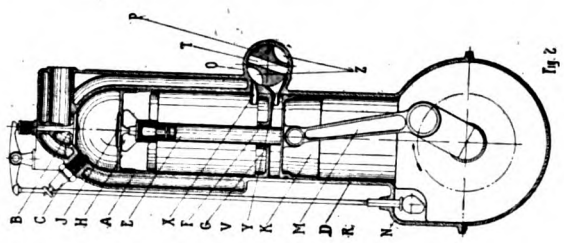
This invention relates to cooled Diesel cylinder covers having one central cylindrical opening surrounding the casing which contains both the fuel and starting valves.



In order to avoid differential expansion and cracking through heat, the cover is designed so that that part which separates the cooling-chamber from the combustion-chamber extends only as far as is necessary to form a tight joint between the cover and the cylinder. The dotted lines on the right-hand side of the figure indicates a construction hitherto known in which the wall is extended radially beyond the joint.

1,274,980. Aug. 6, 1918. Internal-Combustion Engine. P. Brevard, of Weatherford, Tex.

This invention relates to a two-cycle engine and has for its object the elimination of passing of piston-rings across ports, a more efficient scavenging of the cylinder and the development of greater power per stroke. Two cylinders are arranged coaxially of one another and separated by a partition wall G. A rotary-valve controls the inlet of the charge and the connection between upper and lower cylinders. A slot T in the same is connected to the carbureter from where the charge is being drawn. The latter will enter the lower cylinder through port Y, be compressed on the upward stroke of the piston, and whence pass through one of the by-passes Z and through port X, with the pistons at their upper dead center, into the

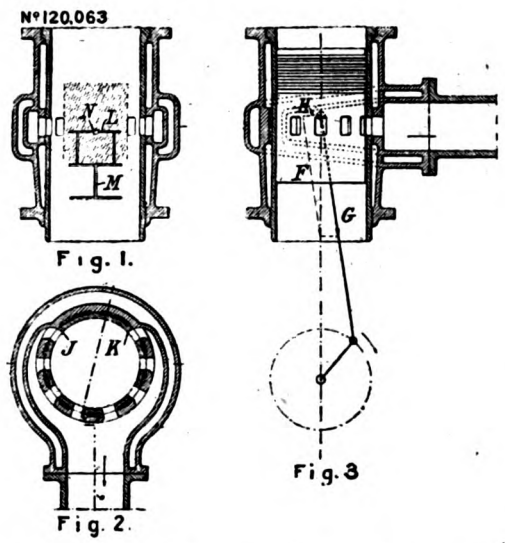


lower part of the upper cylinder, where these gases will be trapped the moment the rotary valve P blanks port X.

Then the pistons are moving downward again on the power stroke, near the end of which the exhaust valve B will be opened, relieve the burned gases, and as soon as the pressure is released the inlet valve J will open automatically and admit the precompressed charge, and sweep out the remainder of the burned gases through said exhaust valve. By this time the slot T of the rotary valve will register with port X, and admit a further charge of fuel and air.

121,063. Apr. 10, 1918. Two-cycle Engine. Schneider & Cie, of Paris, France (British Patent).

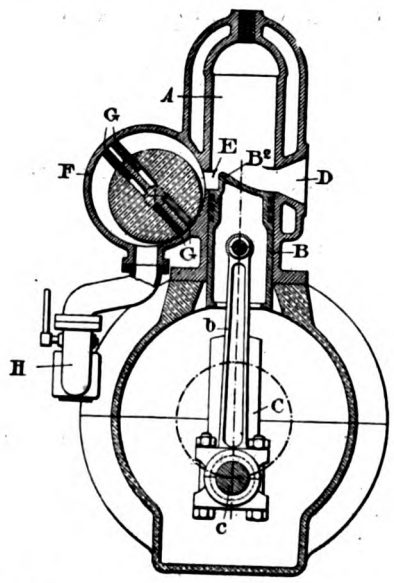
This patent refers to a two-cycle engine with the exhaust ports arranged in the cylinder wall. Hitherto in this type of engine these ports have been disposed in



a row all-way round the circumference of the cylinder. The drawback of this arrangement is a great wear, due to the reduced bearing surface and insufficient lubrication. The object of this invention is to obviate such drawbacks by disposing the ports only part-way round and thus providing a good support for the side thrust of the piston and an adequate lubrication as indicated by the oil grooves L to N.

1,273,667. July 23, 1918. Internal Combustion Engine. J. A. Poyet, of Lyons, France.

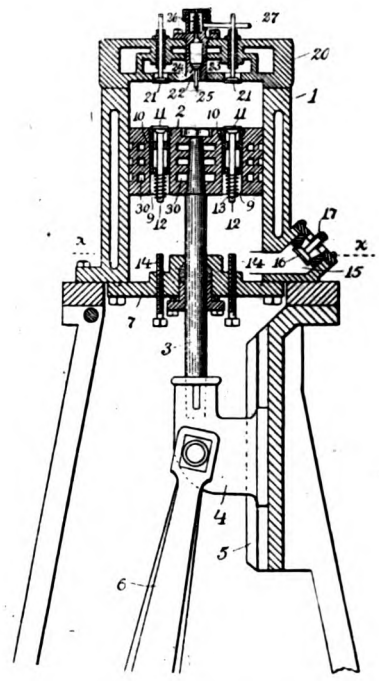
This invention relates to an engine with port-scavenging, on which the feed of the cylinders is effected by an independent rotary pump. The illustration shows the arrangement for a two-cylinder engine,



the pump F, revolving at the same speed as the crankshaft, has two vanes G and is supplying the two cylinders alternately with mixture. The pump is connected to the carbureter H.

1,293,766. Feb. 11, 1919. Two-cycle engine. F. S. Hammond, of Cleveland, Ohio.

This invention refers to a two-cycle engine. The upper part of the cylinder is the working cylinder and the lower part of the cylinder serves as the compressor of the scavenging-air. The air is sucked into the lower cylinder through the valves 16, compressed on the downward stroke of the piston and discharged into the

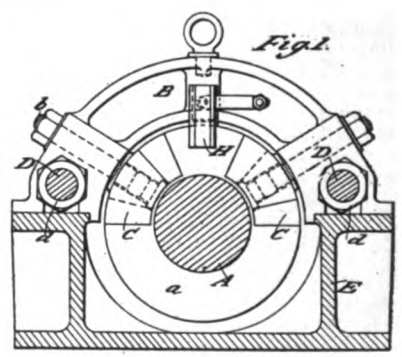


cylinder through the valves 11 in the piston which are mechanically opened by the screws 14.

The fuel is introduced through valve 26 into a chamber in the fuel-valve and the introduction of the fuel into the cylinder is controlled by the working piston itself lifting the valve 25. The exhaust valves 21 are mechanically actuated.

1,289,879. Dec. 31, 1918. Multicollar Thrust Bearing. H. T. Newbigin, of Newcastle-upon-Tyne, England.

This invention refers to an improved marine or double-acting multicollar thrust bearing. On the old horseshoe type only about 50 lbs. per sq. inch can be carried with safety, and coefficient of friction is about 0.03, whereas the Michell bearing, which the inventor has applied to his construction, has been found to carry 200 to 300 lbs. per sq. inch and has a coefficient of friction of 0.0015.



On this construction pivoted stator members or blocks C, capable of taking up thrust in either direction, are suspended from supporting arches B, which are to be adjusted on the two side-screws D in the well-known manner applied to the present type of horseshoe blocks. An oil scraper H is provided so to direct the oil between collar and thrust segment.

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